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General Editor

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MODERN PROFESSIONAL NURSING

VOLUME III

SECTION VI

THEORY AND PRACTICE OF NURSING (PART II)

CHAPTER 1

EXTENSIONS AND PLASTERS

EXTENSION. BALKAN BEAM. SKELETAL TRACTION. SKIN TRACTION. PULP TRACTION. PLASTERS. PLASTER OF PARIS BANDAGES. APPLICATION OF PLASTER BANDAGES. REMOVAL OF THE CAST. NURSING CARE. LOOSE PLASTER. SPECIAL FORMS OF PLASTER SPLINT. OTHER METHODS OF PLASTER APPLICATION. MAKING A PLASTER CAST.

As already mentioned (Vol. II, p. 410) the present-day methods of treating fractures and joint disease are based on immobilization of the affected part and neighbouring joints by application of plaster casings. This may be effected with or without the use of traction, as maintained by various types of apparatus. Traction may also be used in cases in which the splint material is not made of plaster. In this chapter the subject of extension is most conveniently dealt with first.

Extension

Weight extension is applied in the treatment of fractures, joint diseases and various other conditions in which it is necessary to rest the part and prevent the contraction of muscles from giving rise to overlapping of bone fragments or flexion of a joint. The two methods usually adopted are those of 1. skeletal traction; 2. skin traction.

Balkan Beam.—To maintain extension of a limb for several weeks, the most popular type (among many) is the Balkan beam. This is an efficient means of attachment for splints and pulleys in the treatment of fractures of the limb. There are 2 types

the single and the double beam respectively; the former consists of 2 upright wooden or metal posts connected over and under the bed with crossbars. The beam, which can be moved independently of the bed, is an advantage as it prevents restriction in hip abduction, essential in the treatment of certain fractures of the femur.

Double beams are generally fixed and are intrinsic to the structure of the bed. (See Vol. II, p. 418.)

Skeletal Traction.—Skeletal traction has now proved itself to be an efficient means for the application of traction. This method may be applied by means of Kirschner wire or the Steinmann pin.

Kirschner Wire.—Kirschner wire is drilled into the bone with an electric or hand drill; to this wire a stirrup is attached and the wire is rendered taut by the use of a wire tightener; an S-shaped hook is then inserted into one of the holes in the stirrup for the attachment of the weight.

The following equipment is required for this operation: bone drill; stainless steel Kirschner wires; Kirschner stirrup and wire tightener ; stirrup spanners ; wire cutters ; tenotomes ; gauze ; pair of scissors ; mastisol (mastic in benzene).

This method of traction may be used in the arm by inserting the wire into the olecranon process or in the leg by insertion into the calcaneum or tibial tubercle, although Steinmann's pin (see below) is more generally to be preferred in dealing with the leg, owing to the tendency of the wire to cut through the bone. Care must be taken in removing the wire, one end being cut close to the skin and the other being carefully sterilized with surgical spirit ; the surrounding skin should be similarly treated so that infection may not be introduced into the wound. The two skin punctures are then sealed with gauze soaked in mastisol.

Steinmann's Pin.—In the method involving the insertion of Steinmann's pin, the pin is hammered into the bone and the skin around the pin carefully sealed with gauze soaked in mastisol or some other efficient antiseptic collodion paint.

Böhler's swivel stirrup has an advantage over many other types of stirrup : it can rotate on the pin, and so prevent the rotation of the pin itself. This is an asset in the prevention of sepsis, since constant rotation of the pin causes tracking of infection along the pin and then to the bone.

When removing the pin care must be taken to prevent infection ; the entrance and exit wounds, as well as the pin, are both swabbed with surgical spirit ; the pin is then extracted by means of the nail holder. The wounds are afterwards swabbed with surgical spirit and dressed with mastisol. The pin track should be completely closed at the end of 3 weeks.

The following equipment should be prepared for the insertion of Steinmann's pin : bone mallet ; Steinmann's insertor and

pin ; Böhler's swivel stirrup ; tenotome ; sharp scalpel or Bard-Parker knife ; tissue forceps ; Mayo's scissors ; gauze swabs and dressings ; mastisol or desired antiseptic.

Skin Traction.—Requirements : strapping for extension ; wood spreader or lamp wick ; cotton wool ; splint wool ; bandages ; needle and cotton ; prepared splint ; fracture cord ; weights ; scissors ; articles for shaving ; a jug or stone hot water bottle filled with hot water ; tape measure. There are 2 methods involving the same principles and these are therefore described together.

The limb is shaved and the strapping is applied in strips, notched to fit either side of the leg. Ordinary adhesive strapping may be used but the special holland type is better. To use this, hold the dry side against the receptacle of hot water and the

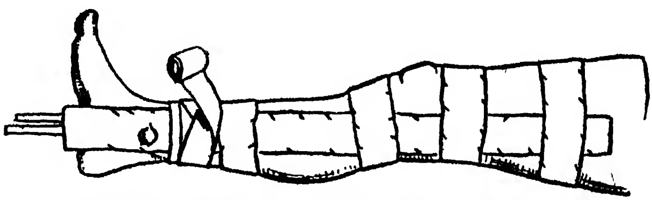

FIG. 1.—EXTENSION PLASTER APPLIED, SHOWING ONE METHOD OF PUTTING ON THE ADHESIVE BANDS AND THE START OF THE EXTERNAL BANDAGE WELL ABOVE THE MALLEOLI.

viscid side will then melt ready for use. The ankles are not covered, but either the strapping is incorporated with the wooden spreader to extend below the sole of the foot, or the lamp wick is firmly sewn to the strapping and tied to the Thomas's splint or Hodgen's splint. Care should be taken that the foot is not plantar flexed. If the spreader method is used, the fracture cord should be knotted through the hole in its centre, and the required weights swung on the lower end. The strapping is covered with an open-wove bandage.

The bed is usually set on blocks and the limb is protected by a cradle.

Pulp Traction.—Traction in the treatment of displaced fractures of the digits (metacarpal, metatarsal and phalangeal bones) is often dealt with by a method described as pulp traction in which the use of stainless steel wire and special rustless nails or pins (Brock's pins) is adopted. These are inserted into the pulp of the finger or toe over the terminal phalanx, the pin then being tied under tension to a Böhler finger splint (see Fig. 3) or to a Cramer wire banjo splint.

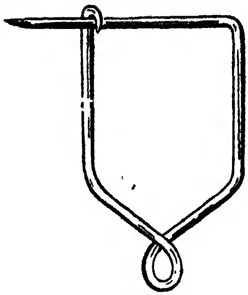

FIG. 2.—BROCK'S PIN.

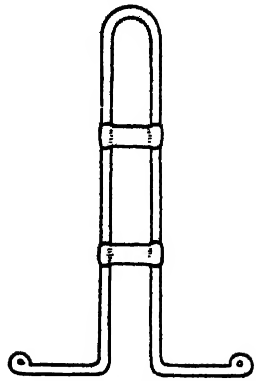

FIG. 3.—BÖHLER FINGER SPLINT.

Plasters

The use of plaster of Paris splints is by no means a treatment of the present day ; records of these methods can be found in the writings of Rhazes, an Arabian physician, as early as the ninth century ; in 1887 further records describe the use of the walking plaster by Krause, who treated approximately 100 fractures of the lower limb by this method. In the twentieth century it has been shown to be one of the most successful methods of splinting. This was especially apparent during the Spanish Civil War and in World War II, in which the plaster of Paris splint was an enormous asset in the transport of the wounded soldier. It has however reached its peak of popularity under the direction of Böhler who has demonstrated the value of its use by means of the walking plaster in its present stage of perfection; thus one may regard plaster splinting as being the acme of splint treatment.

Plaster of Paris Bandages.—The basic material of a plaster splint is the plaster of Paris bandage. This is made as described below. The materials required are as follows.

1. *Fine Dental Plaster.*—Plaster of Paris is made by first heating and then crushing calcium sulphate ; the heating results in the formation of an amorphous anhydrous salt due to loss of water of crystallization. When plaster of Paris is soaked in water, therefore, a chemical union with water takes place and subsequent re-crystallization. It will be clear to the nurse why the completed bandages should be stored in air-tight tins : moisture from the atmosphere must be prevented from penetrating to the plaster and thus starting the process of recrystallization which makes the bandage quite unfit for use.

2. *Book Muslin.*—This should be of a texture represented by

32 threads to the inch. Some orthopaedic surgeons prefer the unstarched muslin, which is said to retain the plaster of Paris powder more easily; this should be cut into strips 2 inches, 4 inches and 6 inches wide; and 4 yards in length.

3. *Tubular Stockinet.*—This material, or plain lint bandages of various widths, will suffice.

4. *White Felt.*—This should be sterilized, owing to the possibility of contamination of the material with tetanus spores.

5. *Large Bucket.*—This should be lined with grease-proof paper which prevents the plaster powder adhering to the bucket.

6. *Fracture or Orthopaedic Table.*

7. *Suspension Frame.*—This should be got ready if required

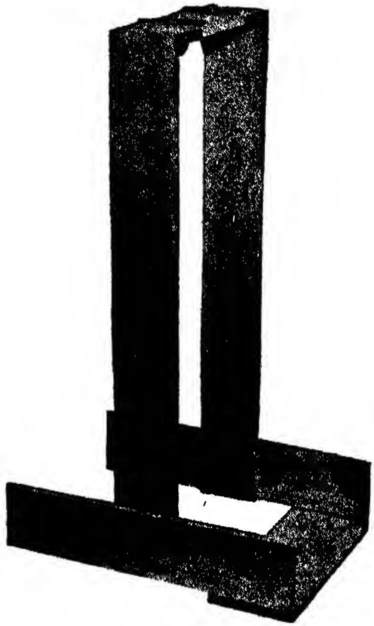

FIG. 4.—GALLOWS SPLINT.

FIG. 5.—GALLOWS SPLINT IN USE FOR SMALL CHILD.

8. *Metal Strips.*—Aluminium or malleable iron strips should be ready, 2 ft. long and of the required width and thickness, usually $1\frac{3}{8}''-1\frac{1}{4}''\times\frac{1}{8}''$.

9. *Tape Measure.*

Procedure.—The first essential is to protect the floor by newspapers or old sheets ; rubber gloves, aprons and gumboots for the operators are also necessary. The muslin strips should have 3 threads drawn from each edge to prevent fraying and to facilitate even unrolling during the application of the plaster; they should then be rolled loosely. A heap of plaster is then placed on a smooth surface, the muslin being unrolled gradually and passed through the plaster so that the plaster is rubbed into it. The bandage is then carefully rerolled, exposing about 12 inches–16 inches to the plaster powder at a time and leaving a thin layer of plaster adherent to the bandage. The bandage should be rolled fairly firmly in order to prevent the plaster from falling out. Each bandage should be wrapped in grease-proof paper in order to prevent moisture from getting in, and should be stored in air-tight tins. Plaster of Paris bandages may also be bought in tins, prepared for application.

Application of Plaster Bandages.—The site of application should be shaved, where necessary, washed with soap and water, dried and powdered, put into the desired position and retained thus until the application is completed and the cast is set. No movement of the limb must occur during the application, otherwise cracking or creasing of the plaster may arise. If creasing should occur after the cast has been applied, it is apt to cause pressure sores.

Padding.—All bony prominences must be padded with felt, which should be rendered adherent with mastisol. If it is desired that the splint should be padded, lint bandages, green flannel bandages or stockinet may be applied to the limb, although the unpadded skin-tight plasters are preferred by many surgeons because complete immobilization of all parts of the limb is thereby produced. Unsatisfactory padding may cause uneven folds to form and so create pressure sores. Woollen bandages should be used as a padding when a plaster cast is applied in the case of compound fractures, acute osteomyelitis and sequestrectomy owing to the presence of reactionary swelling.

Making the Cast.—The plaster bandage is soaked by gently immersing it in a 2-gallon bucket of tepid water to which a handful of common salt has been added. Wait until all bubbles have ceased to appear. The bandage should then be removed and all surplus water gently expressed with both hands ; the water should be allowed to saturate thoroughly so that the bandage can be applied evenly. During application it should be smoothed constantly in order to prevent formation of layers and

to aid the formation of a compact splint. All air bubbles must be expelled, since they are apt to cause cracking of the cast during drying.

Plaster casts may be strengthened first by a reinforcement, in the form of a plaster slab, made from layers of the plaster bandage, and secondly by the insertion between the layers of the plaster bandage of metal strips during the application.

Finally the cast should be smoothed on the surface by rubbing in plaster cream, and the edges of the cast may be trimmed in order to prevent chafing of the skin. If desired, a porcelain glaze can be produced (after the date of the application and the diagram of the affected area have been freshly pencilled) by polishing the whole plaster with the end of a stiff calico roller bandage and dry boric acid crystals. The cast can be made waterproof by the application of shellac varnish ; this is to be recommended when the patient is a young child.

Certain ingredients can be added, such as glue, gelatine or borax (1 tablespoonful to 2 gallons of water), to diminish the drying time and assist in the hardening of the plaster, which should thus be set (when tepid water is used) in 8 to 10 minutes. The normal drying time is 24 hours.

Removal of the Cast.—The essential items required for the removal of a plaster cast are as follows :

Plaster knives ; small- and large-sized plaster shears ; plaster scissors ; plaster spreader, required when the cast is cut by the shears.

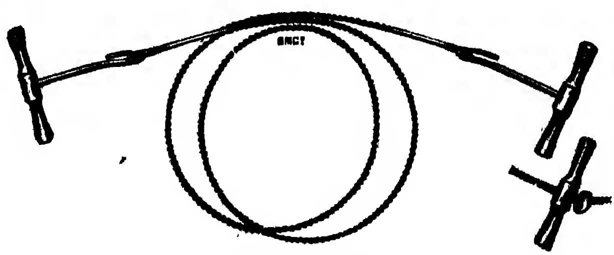

Fig. 6.—Gigli Saw.
(By courtesy of the Surgical Manufacturing Co., Ltd., London.)

There are 6 important points for consideration in the removal of a plaster cast ; these are enumerated below.

1. Cut over the soft tissues of the limb, with the shears.
2. Carefully avoid bony prominences.
3. Take small bites with the shears, with each cut advancing slowly.
4. Carefully avoid pressure on the lower blade of the shears otherwise the underlying skin will be cut.

Fig. 7.—Scuter's Plaster Shears.
(*By courtesy of the Surgical Manufacturing Co., Ltd., London.*)

5. Wash and dry the skin after the removal of the cast.
6. Desquamation should be treated by gentle massage with "Vaseline."

Nursing Care.—Plasters must be protected from abnormal movement or undue pressure in order to avoid cracking. They should be left exposed to the air and never covered with a blanket, otherwise "sweating" will occur.

In the case of plasters applied to lower limbs, the limb should be supported on a pillow or special metal support in order to avoid any pressure on the heel. Patients wearing hip spica plasters should never be lifted or turned by movement of the enclosed limb, since there is danger that the plaster will break.

Oedema, blueness, undue pallor of the limb or a sensation of "pins and needles" must be carefully watched for in the exposed distal part of the limb; these are definite indications of circulatory interference and when they are given the plaster must be split.

Avoidance of Plaster Sores.—Plaster sores are localized areas of gangrene due to constant pressure, which produces ischaemia and finally death of the tissues. A clue to their presence is a discharge from beneath the plaster, due to an ulcer supervening on the separation of a gangrenous slough. Plaster sores may be avoided if the application is evenly and correctly applied and if supervision is constant. Any symptoms of pain or discomfort in the enclosed area should be immediately reported as they are danger signals of an impending plaster sore.

Treatment of the Sore.—When the disaster occurs the surgeon may decide to remove and replaster, or cut out a window over the affected area in order to relieve pressure; this area is covered by a pad of cotton wool, and the window is closed. If the sore has already formed, it must be dressed daily with some antiseptic, such as eusol or acriflavine, until the wound is clean; it is useless to attempt any other measure of treatment.

Loose Plaster.—Excoriation or pressure at the edge of the plaster is a certain sign that the plaster is too loose, and the pernicious habit of tucking in cotton wool must be avoided since this only increases the pressure; the really satisfactory treatment is reapplication of the plaster, ensuring its correct position.

Special Forms of Plaster Splint.—1. *The Bavarian Splint.*—In order to obtain an accurate pattern, it is advisable to take an old stocking belonging to the patient, and to cut off the toe and the heel. The stocking is split vertically in front, and the pattern is provided as shown in the illustration (Fig. 8). Over this place two layers of old flannel, well shrunk, and cut both exactly to the shape of the pattern. Fix the two layers down the middle by a double row of stitches, thus an appliance like a four-leaf folder is made. The limb is raised and placed over the flannel with the middle of the back of the leg over the seams. The medial folds are drawn forward and fixed in front with safety pins (Fig. 9). Over this is moulded a layer of plaster cream, about ½ inch in depth. Then the outer folds are brought round the limb, pressed into the plaster, and left. The whole may be enveloped in an open-wove bandage. The safety pins are then removed.

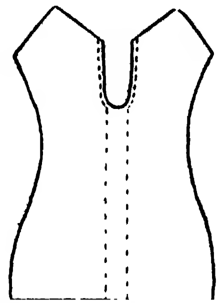

FIG. 8.—PLAN OF BAVARIAN SPLINT.

2. *Croft's Splint.*—This has the same pattern as above, except that the layers are not joined together. There are thus two layers of flannel which exactly fit the inside of the leg, and two which exactly fit the outside. One of the layers is carefully fitted to the limb; it is covered with a substantial amount of plaster; meanwhile the corresponding layer has been soaking in plaster cream; it is accurately placed over the first. The same procedure applies to the remaining aspect of the limb. Two half-moulds are thus formed, and they are firmly bound by an open-wove bandage. Next day, the front portion of the bandage

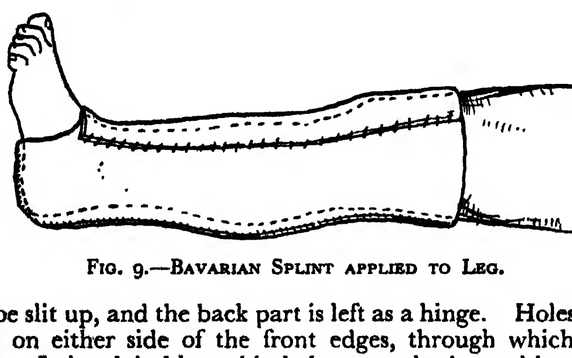

FIG. 9.—BAVARIAN SPLINT APPLIED TO LEG.

may be slit up, and the back part is left as a hinge. Holes can be made on either side of the front edges, through which a lace passes. It is advisable to bind the ragged edges with adhesive plaster. The splint is thus movable, and allows the performance of daily massage and movements.

3. *Spinal Jackets.*—These may be necessary in disease of the spine. The patient is carefully prepared in the usual way, and should be covered with a well-fitting woollen or flannel vest. The body is slung from a tripod, only the tips of the toes touching the bed, then the plaster is applied in the usual way. A cotton wool pad is placed over the upper abdominal region; this is removed as the plaster sets, and thus leaves the stomach area visible. The jacket should extend from the axillae to the hips. Drying often occupies 24 hours; the patient is laid on a mattress at the side of the fire and "toasted" for a certain period on each side; care must be taken to screen the face. Drying may also be done by using a radiant heat cradle. Once the plaster has set, it can be cut open down the front and laced as in the Croft's splint. Poroplastic jackets are sometimes used also.

4. *Plaster Bed.*—The following are the requirements. A firm table, plaster of Paris, hot water, double sheets of muslin the required width and length, a large spoon for mixing, cotton wool and warmed olive oil. After everything is ready, plaster cream is mixed, the water being at 110° F. The strips of muslin are then well soaked in the paste, but before they are applied, the body is well rubbed with olive oil and the cotton wool put into any parts that need special protection e.g. the perineum. Each strip is quickly applied before it has time to harden. A strut is usually made to keep the legs apart. The edges are rounded and made smooth. At the close of the operation the plaster is allowed to set, then the case is removed and the oil is wiped from the patient's skin. The plaster takes up to 2 days to dry. Commonly a turning case is also made to allow of nursing care being given to the patient without alteration of position.

Other Methods of Plaster Application.—When starch is used, it is made into a jelly and applied and dealt with very much the same as plaster of Paris. Water-glass can also be used if desired; it dries as silicate of sodium, held together by the meshes of the bandage. Drying takes anything from 12 to 24 hours. Pexuloid, which is a non-inflammable celluloid, is used to form a celluloid splint from a cast, made as described below. Stockinet having been tightly drawn over the cast, a layer of pexuloid is painted on, and a covering of muslin; as each layer dries, it is covered by another; it may take a whole day for one layer to harden. Ultimately, when the splint is of sufficient thickness, it is varnished with cellulose triacetate, and left for nearly a week. It can then be detached from the cast by cutting down the side or the middle in front. The edges are trimmed, bound with leather or muslin and celluloid solution, eyelets are made, and the splint is ready for application over a limb, which should first be covered by a carefully fitted stocking or other garment.

Making a Plaster Cast

Plaster cream is made up as described above. It is applied to the limb on the usual bandages, but there is no cotton wool, the skin itself being shaved, greased with olive oil or "Vaseline," and thus a very careful impression taken. When dry, but not too hard, the mould is cut down one side and carefully removed. It is well greased internally, no part being left untouched ; this is important to the final success. The mould is called the negative. It is filled with cream which is allowed to run into every corner, then bound together with tight bandages. Half an hour afterwards, the negative should be easily detached from the cast inside, which is now called the positive. The latter is trimmed, smoothed and polished, in the usual way common to sculptors. Now and then, in large casts, various metal pieces are added to make a matrix round which the plaster can form a strong superstructure.

CHAPTER 2

SOME SPECIAL LOCAL TREATMENT METHODS

(A) PREPARATION FOR RECTAL EXAMINATION. (B) PREPARATION FOR VAGINAL EXAMINATION. (C) ARTIFICIAL FEEDING. THE NASAL METHOD. OESOPHAGEAL FEEDING. FEEDING BY RECTUM. FEEDING BY GASTROSTOMY TUBE. (D) TEST MEALS. EWALD'S TEST MEAL. BOAS'S TEST MEAL. FRACTIONAL TEST MEAL. (E) IRRIGATION. RECTAL LAVAGE. STOMACH LAVAGE. IRRIGATION OF THE THROAT. NASAL IRRIGATION. IRRIGATION OF THE EAR. BATHING OF THE EYES.

(A) Preparation for Rectal Examination

WHEN a rectal examination is ordered, the nurse must tell the patient what is about to be done, and be certain that the bladder is empty. When an ordinary manual examination is to be done the patient will be examined in bed, but when the proctoscope is to be used (an instrument for examining the inner surface of

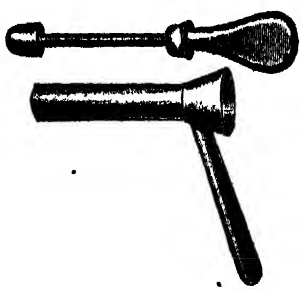

FIG. 10.—KELLY'S PROCTOSCOPE.

FIG. 11.—FINGERSTALL AS USED FOR RECTAL EXAMINATIONS.

(By courtesy of the Surgical Manufacturing Co., Ltd., London.)

the rectum), the examination will probably be conducted in the operating theatre, with the patient under an anaesthetic.

In the latter case, an enema must be given not more than 3 hours beforehand. On the trolley is put a kidney basin containing rubber gloves or rubber finger stalls. Swabs of gauze and cotton wool should also be provided, a weak antiseptic for the toilet of the anus, a small jar of boric acid in soft paraffin (or

a tube of lubricating jelly) and glove powder for the surgeon's hands. The bed should be screened off.

To put the patient in the most satisfactory position for the doctor, place him on his right side with the head at the top right hand corner of the bed and the buttocks as near to the

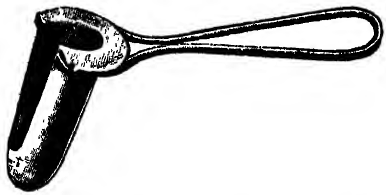

FIG. 12.—LOCKHART-MUMMERY'S RECTAL SPECULUM.

FIG. 13.—SIMS'S SPECULUM.

(*By courtesy of the Surgical Manufacturing Co., Ltd., London.*)

left hand edge of the bed as possible. The left thigh should be well drawn up For this examination, the bedclothes may be rolled up from the bottom of the bed to a point just above the hips. Till the doctor is ready, the legs may be covered with a blanket. A waterproof sheet covered with a towel should be placed below the buttocks.

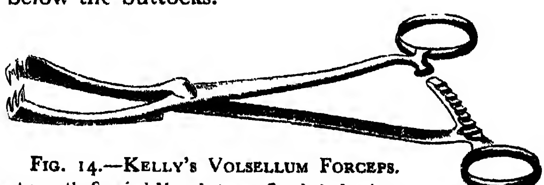

FIG. 14.—KELLY'S VOLSELLUM FORCEPS.
(*By courtesy of the Surgical Manufacturing Co., Ltd., London.*)

(B) Preparation for Vaginal Examination

The rectum and bladder should be prepared as above. In addition to the equipment mentioned above, there should also

FIG. 15.—RUSSELL SIMPSON'S UTERINE SOUND.
(*By courtesy of the Surgical Manufacturing Co., Ltd., London.*)

be provided a Sims's speculum (Fig. 13), a pair of volsellum forceps (Fig. 14), and a uterine sound (Fig. 15). All equipment must be sterile in this case, and the doctor will scrub up and dry his hands on a clean towel before powdering them and putting

on a pair of gloves. Clean glass slides should also be handy in case a smear should have to be taken.

The patient may lie in 3 different positions according to the requirements of the surgeon or the nature of the case.

These positions are as follows.

1. The right lateral position as described in the previous paragraph.

2. The flat supine position, with the hips slightly raised if necessary.

3. Sims's position ; the patient is placed on the left side, then the left arm is allowed to hang over the edge of the bed while the face is turned towards the pillow ; the right thigh is drawn up.

The doctor may examine with two hands or one and may require the patient to be turned into various positions. The nurse must never leave the patient during the examination. For these examinations a good light is essential, and a hand lamp should be in readiness.

(C) Artificial Feeding

When the food cannot be taken in the usual way by the mouth, or in certain cases of shock, artificial methods must be adopted. These are respectively the nasal method, the oesophageal method, the rectal method and the gastrostomy method.

The Nasal Method.—Nasal feeding is resorted to when there is a disease of the soft palate, tonsils or other buccal areas, which may be swollen or painful. Occasionally it is required on account of muscular paralysis during the course of diphtheria. It may also be used in unconscious patients, in those who are on hunger strike and in hysterical and mentally deficient patients.

The apparatus required is a nasal catheter (No. 8), joined by a well fitted glass connexion to about 2 feet of rubber tubing, at the end of which is fixed a glass funnel or small syringe barrel. The feed, which may be a strained soup, egg flip or milk, is kept in a feeding cup placed in a basin of hot water so that the temperature may not be less than 100° F. The patient is usually recumbent, but when possible the head should be bent forward as this facilitates the passage of the tube. A mackintosh sheet covered with a towel is wrapped round the upper part of the chest and shoulders; it is often advisable to tuck in the arms as well.

The nostrils should be cleared with cotton wool swabs wrapped round the ends of orange sticks and dipped in olive oil. Then the air should be pressed out of the tube, and the end of the catheter smeared with a thin layer of sterile soft paraffin before the feed

is given. The nurse takes the catheter in her right hand, passes it slowly and gently up one nostril, "feeling" the roof of the nostril as she proceeds. When the end of the catheter reaches the posterior nares, it may droop slightly; in this event the nurse should not be alarmed; she should allow the point to travel back until the soft posterior wall of the pharynx is reached, after which it is not difficult to pay out the rubber tubing and to allow the catheter to go down into the stomach via the oesophagus. Once the tube is in the stomach the patient will be less frightened (and it is not out of place to say that probably the nurse will also be thankful) and tests can be made to ensure that the catheter has not gone into the larynx. This accident rarely happens, as the spasm of the epiglottis is too strong for the catheter and, in addition, the asphyxiating reaction of the patient gives abundant warning. If the tube is in the stomach bubbles of air will be heard regularly escaping from the stomach; by pressing on the epigastrium the nurse can force out more gas. The chief test, however, is the distance travelled by the rubber tubing. Usually there is a mark made on the tube which indicates, when it is on a level with the entrance of the nostrils, that the tip of the catheter is in the stomach. The variations of individuals are negligible. Children are in a different category; they require to be handled very carefully and sometimes they have to be restrained, but once they overcome their fear they behave very well. The more complete the relaxation and quietude of the patient, the better the result. A child usually requires about 12 inches of the tube.

Once the tube is in, no time must be lost in giving the feed. It is useless to start, however, until all the inevitable coughing and spluttering is over. A little sterile water should be given by the tube, immediately followed by the soup or whatever the feed may consist of. The fluid should be passed slowly but steadily; if there is a break in the stream, airlocks may occur, and the rubber tubing may require to be stripped by running the thumb and forefinger down the tubing towards the nose. In withdrawing the tube, plenty of time should be taken and the thumb and forefinger should grip it tightly in order to prevent the back-flow of the feed left in the tube. The catheter, tube, funnel and connexion should all be very carefully washed and cleared of every particle of food. The whole apparatus may be stored in a large glass jar containing a solution of boric acid.

Oesophageal Feeding.—Here much the same procedure as the above is carried out, but the tubing is thicker and often a specially made rubber stomach tube is used. Oesophageal feeding is employed after operations on the mouth and tongue and in conditions of painful tumour of the oesophagus, spasm or stricture not due to cancer. The mouth should be irrigated first

(D) Test Meals

There are numerous ways of examining the stomach contents. Apart from the vomitus of ordinary sickness or the frothy juices brought up when there is extreme retching, the gastric juices may be examined in their pure state, or portions of a test meal may be analysed in order to find out how much gastric digestion is going on. When any special examination is to be made it is usual to pass a siphon tube and to draw off the contents mechanically, as they can then be properly investigated by the latest scientific methods. The chief finding is the amount of hydrochloric acid in the stomach, but it is possible also to determine the excess or shortage of bile, mucus, lactic acid, " free " acid, total acidity, total chloride salts and the presence of starch and blood. The actual testing need not concern the nurse as it must be done by the biochemist or clinical pathologist. As a result of the various tests it is possible to find out the cause of the defect and also to apply the appropriate treatment, which is the nurse's province.

Ewald's Test Meal.—The quantities vary according to the type of test, but as a general rule the ordinary adult is given, on an empty stomach, either 2 oz. of dry toast, well done, or a bread roll, with a large mug of weak tea (1 pint) without sugar or milk. If the test meal be given at 8 a.m., it should be removed at 9 a.m.

For the removal of the test meal, the apparatus required is a stomach tube about 30 inches long, fitted with a funnel. A small black mark on the tube indicates the point at which the incisor teeth should touch when the tube is properly in the stomach. Mackintosh and towel are placed round the patient's neck, and on the cupboard at his bedside should be a tray containing an enamel porringer, a glass receptacle for the vomitus specimen, a tumbler of warm water and if necessary a lubricant.

In passing the stomach tube, it is a simple matter provided the patient be not frightened or fussy and in this matter much depends upon the doctor and nurse.. It is not difficult to pass the tip of the tube into the stomach when the tube is icy cold. The patient sits up ; he is told to crane his neck forward a little as if he were eager to swallow the tube. He opens his mouth wide ; the operator, standing at the right of the patient, boldly but carefully passes the cold tube to the back of the pharynx, the patient assisting the descent by making an effort to swallow. When the mark is opposite the incisor teeth, the patient should be asked to give a slight cough, or his epigastrium may be gently pressed for a moment. The food should be received into the porringer, and transferred later to the specimen glass. The stomach tube should be removed gradually and received into a large enamel

basin. Then warm water should be slowly sipped in order to act as a stomach sedative.

Boas's Test Meal.—This is often substituted for Ewald's meal. It is made by adding 1 tablespoonful of oatmeal to a

FIG. 16.—RYLE'S DUODENAL TUBE.

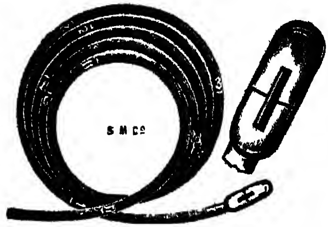

FIG. 17.—EINHORN'S DUODENAL TUBE.

(By courtesy of the Surgical Manufacturing Co., Ltd., London)

quart of boiling water and gradually reducing the whole to the volume of 1 pint. The fine porridge is then strained and 6 oz. are given at 8 a.m., the stomach contents being removed an hour later.

Fractional Test Meal.—This is a more modern method, and very useful for all kinds of diagnosis and treatment. After supper 2 charcoal biscuits are given; further food or drink must not be taken until the test is completed.

Preparation.—12 test tubes or bottles marked with numbers 1 to 10 and marked "Resting Juice" and "Residue" respectively should be got ready. A Ryle's tube (sterile), a 20 c.cm. syringe, clip, strapping, mackintosh, a mouth wash and gruel are also needed. The test meal is made by boiling 1 oz. of fine oatmeal in 2 pints of water until the quantity is reduced to 1 pint; strain before use.

Method.—Pass the Ryle's tube. Draw off the resting juice with the syringe. Instruct the patient to drink the gruel. Every 15 minutes draw off a specimen, putting it in the appropriate bottle. The last specimen is the Residue.

During the process the end of the tube can be strapped to the patient's cheek. He can be given a bell, with instructions to watch the clock and ring at the appointed time. At the end remove the tube and give the patient a mouth wash and some nourishment. The bottles are then labelled and sent to the pathological laboratory for analysis.

(E) Irrigation

Lavage, or irrigation, may be carried out in various organs, the commonest being the rectum, stomach, throat, nose, ears and eyes.

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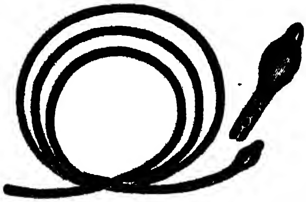
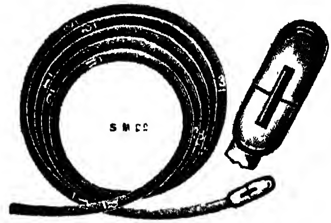


FIG. 16.—RYLE'S DUODENAL TUBE.



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(E) Irrigation

Lavage, or irrigation, may be carried out in various organs, the commonest being the rectum, stomach, throat, nose, ears and eyes.

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Rectal Lavage.—There are different ways of giving this treatment, which is useful in all cases of chronic diarrhoea or in any condition of the bowel in which the effect of an antiseptic, astringent or soothing lotion may be required. The patient should be either in the left lateral or the dorsal position and as far as possible his cooperation should be secured before the procedures begin. A long rectal catheter may be used, and it is advanced slowly as the bowel fills with the fluid, which should douche out the lower part of the descending colon. For an adult, it is customary to give normal saline, or a solution of sodium bicarbonate (1 teaspoonful to the pint) up to 6 pints. The temperature should be about 105° F., so that the lotion will be roughly 100° F. when it reaches the colon. Massage may be done to assist the passage of the fluid upwards. By using the slow enema method a thorough cleansing may be effected, the patient returning the fluid after it has been in the bowel for as long as he can keep it, usually a few minutes. If the siphon method is used, only 2 pints can be given and the contents are returned as soon as the funnel is lowered. In either case careful comparison is made between the amount of fluid run in and the quantity received back into the pail.

Stomach Lavage.—When vomiting becomes intractable or in cases in which there is narcotic poisoning, the stomach may be washed out. It is the best treatment for an overdose of alcohol, with coma. The stomach becomes dilated in cases of pyloric and of intestinal obstruction and it should be washed out before operation.

The ordinary stomach tube is the best, as employed in the Ewald test. In the case of comatose persons it may be necessary to pass the tube with the patient in the recumbent position, but it is better if he can sit up. Weak mustard and water may be used for alcoholics; the fluid is poured from a height and 1–2 pints are put in. The result is usually complete evacuation of the poisonous stomach contents. In the conscious cases the washing may have to be done until the returned fluid is quite clear; weak "Condy's Fluid," saline solution, boric acid or sodium bicarbonate are all useful. About a pint is given at a time from a large enamel jug, the contents of which are at a temperature above 100° F. The tube is clamped, the stomach wash is poured into the funnel, which is held well above the patient's head, and when the clamp is released the fluid goes into the stomach with a certain amount of force. To begin with, the patient usually vomits, so that a large enamel basin should be set in front of him. Patients can become quite expert at passing the tube themselves and all they require after a time is assistance with the lotion. In order to empty the stomach properly each time, the funnel must be brought as low as possible and the tube

must contain a column of fluid, so that the siphonage may not be broken. The returned fluid should be received into an enamel bucket placed on the floor or on a low table (Fig. 18).

Stomach lavage can also be accomplished by passing a Ryle's tube and using a large syringe (see p. 19). An even more modern method is that of continuous stomach suction.

Irrigation of the Throat.—The throat may be dealt with in several ways. The simplest is the gargle, which is a method of washing out the pharynx, tonsils, posterior nares and mouth by taking a full mouthful of an antiseptic solution, tilting the head backwards and keeping the fluid bubbling at the back of the mouth by making vigorous exhalations. The mouthful is expectorated and the process begun again. Sometimes it is necessary to paint the throat with glycerine and tannin, or with iodine ; care should be taken not to prod the tonsils and not to cause reflex vomiting due to tickling of the nerve endings. The patient should be told to sit up, hold his mouth wide open and keep on saying the word "Ah." A tongue depressor may be required. Sprays of various kinds may also be used to spread drugs over the throat.

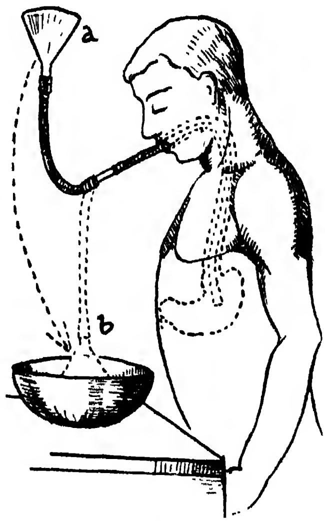


FIG. 18.—GASTRIC LAVAGE.

So far as children are concerned the irrigation of the throat is a very difficult matter, and conditions are often complicated by the fact that a child with serious diphtheria may not be able to sit up. After removal of the tonsils, and in conditions of thrush and similar affections the operation can be carried out by using a small rubber ball syringe which is entered between the gums behind the molars, care being taken that the head is well forward and that the child does not draw any of the fluid into the trachea during inhalation. The head should be held firmly, but it is useless to attempt vigorous coercion as the fright may be worse than the cure.

Nasal Irrigation.—This can be done in several ways. First there is the method of syringing, which is done with a glass syringe or a rubber ball syringe. Great care must be taken not to damage the mucous membranes or to drive septic matter into the

pharyngotympanic tube. The aim of the nurse should be to wash away any discharge by gently softening the mass lowest down, and thus progressing slowly upwards until all the plug is removed. For adults a much better system is that of douching, in which a glass funnel, or douche can, preferably the latter, is fixed 9–12 inches above the patient's head. It is connected by rubber tubing to a glass nozzle. The clamp should be close to the douche can, which may contain normal saline, sodium chloride solution or sodium bicarbonate solution at a temperature of about 105° F. The chest and shoulders are protected by a mackintosh and towel, while a bucket is put at the patient's feet; he may sit or stand. He also holds an enamel kidney basin in his hands to catch any mucus, or other discharge. When all is ready, the clamp is loosened. The patient should be told to take short breaths during the operation. The end of the nozzle need not be inserted more than ½ inch up the nostril. In some cases, a lotion can be " drunk " through the nostrils from an enamel mug. The patient bends slightly forward over the bucket, takes the mug in his right hand, tilts the mug under his nose, and sniffs up the fluid through his nostrils by taking an exceptionally deep breath. This fills both nostrils. At this stage, the mug is removed from the nose, while the patient snorts down vigorously. The procedure is repeated until the lotion is used up. There are also numerous sprays for the nose, these acting by spreading a fine vapour of pine oil or other nasal antiseptic over the lining of the nose. In some cases, special glass containers with nozzles are provided for lotions, but as a rule this method is not so successful as the enamel mug method.

Irrigation of the Ear.—Of all operations, the syringing of the ear is one of the most delicate and most important, yet it is surprising to see how many people undertake to syringe out the ears without really knowing how to do it. The syringing of the ear should never be done without a doctor's permission, and in many cases the doctor prefers to carry out the treatment himself. It is quite safe to put in medicated drops, or to swab out the canal with hydrogen peroxide, but when syringing is necessary it is imperative that absolute conformity to the following method should be made.

The patient sits on a chair, a mackintosh round his neck and covering the rest of his body. He holds a kidney basin with the concave border pressed to his cheek immediately below the ear. The nurse has the lotion, at a temperature of 100° F., all ready in a sterile basin or glass jar. The syringe should be a metal aural syringe and the piston should be tight but not too stiff. It is essential that a considerable force should be present in the jet of lotion. The barrel of the syringe is filled slowly, care being taken that all air is excluded by pushing up the piston until the

liquid spurts out. The nurse gently pulls up the pinna with her left hand and passes the point of the nozzle along the upper part of the canal following the direction of the passage and making sure by depression of the handle of the syringe that the point is on the roof. This is important, as it not only prevents the stream from being directed straight on to the drum —it ensures that in the event of a wax plug being present the wax is not driven hard against the drum, but is loosened above and propelled out of the canal by the fluid behind. This simple operation is one that can only be done after some experience, yet it is one of the most commonly required treatments in general practice. In order to clear the ear of water or lotion, the patient should incline the head towards the kidney basin. The nurse should complete the operation by swabbing the canal with a blunt probe to which a small cotton wool pledget is fixed.

Ear Drops.—To insert drops into the ear a pipette, previously warmed, should be used. The patient should lie on his side with the sound ear on the pillow. After insertion of the drops, he should be kept still for at least 5 minutes; the meatus is then gently dried. Sometimes a plug of sterile cotton wool is left in.

Bathing of the Eyes.—For this a special apparatus, called the undine irrigator (Fig. 19), is used ; it is very like a miniature retort as found in chemical laboratories. Many people prefer to drop lotions into the eyes with a small glass tube drawn to a fine point and emptied by a rubber teat. At all times the operation must be regarded as a strictly aseptic one, since many eye inflammations are very infectious. The best way to carry out the treatment is to surround the patient with a mackintosh as before, and standing behind him, place a towel round his head as close to the eyebrows as possible. The head can then be bent back as far as possible, so that the eye sockets form cups for the lotion. The patient may hold a kidney basin close to his cheek. If the undine is used, the two eyelids are widely opened by the left forefinger and middle finger of the nurse, while she lets the lotion flow from the nasal side outwards. Before using the lotion the nurse should test the heat by pouring a few drops on to the back of her own hand and again the flow should be first directed on to the patient's cheek and gradually brought up to the eye. A saturated solution of warm boric acid is generally used. In the eye dropper method, generally employed for stronger lotions, the lotion is introduced by steady drops, while the patient is put through a form of eye drill, looking in various directions as ordered. This allows the eye to be slowly washed in an antiseptic for a much longer period than with the undine. The

FIG. 19.—UNDINE. (*By courtesy of the Surgical Manufacturing Co., Ltd., London.*)

various eye glasses which are sold as douche glasses are not of much use unless the eyelids are opened wide while the glass is held close to the surrounding skin. As a matter of fact, this is the very thing that is almost always difficult to do, and the operation is usually unsuccessful because the lotion often trickles down the cheek without touching the eyeball.

CHAPTER 3

PHARMACY AND DRUG ADMINISTRATION

WEIGHTS AND MEASURES. MASS. CAPACITY. LENGTH. CONVERSION TABLES. IMPERIAL TO METRIC. METRIC TO IMPERIAL. SUNDRY OTHER EQUIVALENTS. LOTIONS IN WARD USE. BORIC ACID LOTION. PHENOL LOTION. LYSOL GROUP. MERCURY PERCHLORIDE LOTION. FORMALIN LOTION. BINIODIDE OF MERCURY LOTION. PERMANGANATE OF POTASH LOTION. METHYLATED SPIRIT. SURGICAL SPIRIT. PEROXIDE OF HYDROGEN. NORMAL SALINE. OTHER STOCK LOTIONS. ADMINISTRATION OF DRUGS. GIVING DRUGS BY MOUTH. INHALATION. INUNCTION. DRUGS PER RECTUM. IONIZATION. INSUFFLATION DROPS. INJECTION. HOW AND WHEN TO GIVE DRUGS. PREPARATION FOR INTRAVENOUS AND SUBCUTANEOUS INFUSIONS. NORMAL SALINE. INTRAVENOUS INFUSION. SUBCUTANEOUS INFUSION. RECTAL INFUSION. BLOOD TRANSFUSION. VENESECTION.

IN Vol. II, pp. 338–344, the more elementary aspects of drugs and their administration were considered, and it is necessary now to discuss in greater detail many important pharmaceutical points as well as the various ways in which drugs may be given.

Weights and Measures

For the Imperial System, see Vol. II, p. 342.

The Metric System is used abroad and is also universally employed in scientific work ; the summary given below will be useful to nurses.

Mass.—1 milligramme (mg.) = 0·001 gramme.
1 centigramme (cg.) = 0·01 gramme.
1 decigramme (dg.) = 0·1 gramme.
1 gramme (g. or grm.) is the unit of weight, and is the weight of one cubic centimetre of distilled water at a temperature of 4° Centigrade.
1 dekagramme = 10·0 grammes.
1 hectogramme = 100·0 grammes.
1 kilogramme = 1,000·0 grammes (commonly called kilo).

Capacity.—

1 centimil (cl.)	=	the volume of	1 cg.	of water at	4° C.
1 decimil (dl.)	=	„	1 dg.	„	„
1 millilitre or mil (ml.)	=	„	1 grm.	„	„
1 centilitre	=	„	10 grm.	„	„
1 decilitre	=	„	100 grm.	„	„
1 litre (lit.)	=	„	1,000 grm.	„	„

N.B.—For all practical purposes 1 litre is equivalent to 1,000 cubic centimetres (c.cm.); 1 millilitre is therefore equivalent to 1 c.cm.

Length.—1 micromillimetre or micron (μ) = 0·001 millimetre

1 millimetre (mm.)	= 0·001 metre.
1 centimetre (cm.)	= 0·01 metre.
1 metre (m.)	= unit of length.

Conversion Tables

Imperial to Metric.—(*a*) *Mass.*—

1 grain	=	0·06 gramme.
1 ounce	=	28·34 grammes.
1 pound	=	453·59 grammes.

(*b*) *Capacity* :

1 minim	=	0·061 mil.
1 fl. dr.	=	3·55 mils.
1 fl. oz.	=	28·412 mils.
1 pint	=	568·245 mils.
1 gallon	=	4·5 litres.

Metric to Imperial.—

(*a*) *Mass* :

1 milligramme	=	0·0154 grain.
1 centigramme	=	0·154 grain.
1 decigramme	=	1·543 grains.
1 gramme	=	15·432 grains.
1 kilo	=	15,432·356 grains (nearly $2\frac{1}{4}$ lb.).

(*b*) *Capacity* :

1 centimil	=	0·169 minims.
1 mil.	=	16·95 minims.
1 litre	=	35·196 fl. oz. (just over $1\frac{3}{4}$ pints).

Sundry Other Equivalents.—

1 metre	=	39·37 inches.
1 inch	=	2·54 cm.
1° F.	=	$\frac{5}{9}$° C.
1° C.	=	$\frac{9}{5}$° F.

The conversion rule of temperature is as follows.

To convert Fahrenheit to Centigrade subtract 32, then multiply by 5 and divide by 9.

To convert Centigrade to Fahrenheit first multiply by 9, then divide by 5 and add 32 to the result.

Lotions in Ward Use

The following lotions are usually stored as stock solutions in the side room of the ward, where they are kept under lock and key, owing to the fact that most of them are powerful poisons. The strength of the solution varies according to the hospital. Those mentioned below are merely given as examples.

1. **Boric Acid Lotion.**—This is a clear fluid not soluble in water. It is supplied from the dispensary as a saturated solution. In the ward, it may be diluted with its own bulk of water, after which it is used in many ways for irrigations and for cleansing. It is not a very powerful antiseptic. The older and now obsolete name, boracic acid, may still be used.

2. **Phenol Lotion.**—The older name is carbolic acid. The usual strength is 1 in 20, i.e. 5 per cent or 1 oz. to 1 pint. In this form it is a very powerful disinfectant, being used for urine and faeces, bedpans, urinals and other ward equipment; it is a preservative and disinfectant for ligatures, sutures and rubber tubing. As an antiseptic gargle it may be reduced to a strength of 1 per cent by adding 4 times the volume of water. For general wound toilet a 1 in 40 solution or a 1 in 80 solution is used. Care must be taken that phenol is not absorbed through the skin, either by the patient or by the nurse, as it causes serious kidney disorganization. Owing to the fact that it has a clear syrupy appearance phenol is usually tinted pink.

3. **Lysol Group.**—This includes substances such as "Izal", "Cyllin", cresol, "Creolin", "Jeyes Fluid" and many other proprietary lotions. Like phenol, they are derived from coal tar, and they are supplied in 100 per cent strength. A 1 in 80 solution is generally used for disinfection of various utensils, such as bedpans, urinals, enamel ware and similar containers, while pure lysol containing surgical spirit (5–10 per cent) is used for the sterilizing of sharp instruments. Care should be taken not to use lysol in too strong solution for the hands ; it is a powerful disinfectant, strong smelling and cloudy when added to water, and although it is not so toxic as phenol it may cause destruction (dermatitis) of the skin.

4. **Mercury Perchloride Lotion.**—The commonest strength in use is a 1 in 1,000 solution, and the bottle may be labelled "Lotio hydrargyri perchloridi." It is one of the strongest poisons known. It cannot be used for instruments, as it has a

chemical action on the plating, and it cannot be used with soaps unless specially intermixed. But it is a very good disinfectant for the hands, in 1 in 1,000 strength. Blue is the usual tint added to distinguish all mercury perchloride solutions from others.

5. **Formalin Lotion.**—The irritating odour of this lotion is well known. It contains about 40 per cent of formaldehyde, a vapour which is very useful in disinfection, as it is harmless to clothing. A solution may be supplied for the ward or operating theatre in 1–2 per cent strength and it can be reduced for various purposes. Thus in 1 per cent strength it can be used for disinfecting instruments and ligatures with the addition of borax to prevent rusting. Formalin is commonly employed for the hardening of pathological specimens. Formalin tablets are commonly used to sterilize gum elastic catheters and bougies.

6. **Biniodide of Mercury Lotion.**—This substance is very like perchloride of mercury in action. It has also the same strength in solutions supplied to the wards, 1 in 1,000. It is used instead of mercuric chloride because it does not coagulate albumin; it is neither so poisonous nor so destructive to the tissues. It is usually coloured pink.

7. **Permanganate of Potash Lotion.**—Popularly known as "Condy's Fluid", this lotion is useful in 1 per cent strength as a disinfectant, but the disadvantage is that it quickly becomes weak, when it turns brown in colour and muddy instead of mauve and clear. Diluted to 1 in 500 strength, it is a good mouth wash or lotion for cleansing the tissues affected by gonorrhoea; in mild cases 1 in 1,000 strength may be used.

8. **Methylated Spirit.**—This solution is usually coloured pink; it consists of alcohol 95 per cent, wood naphtha 5 per cent. When water is added to it, it becomes cloudy. This is used for drying barrels of syringes, as an evaporating lotion and as a hardening lotion for the skin. A little methylated spirit placed in an enamel basin and set alight will ensure that the internal surface is aseptic.

9. **Surgical Spirit.**—The *spiritus chirurgicalis* as approved by the Board of Customs and Excise may be made up in 2 ways as follows: 1. Castor oil, ½ fluid oz.; methyl salicylate, 4 grains; ethyl phthalate 192 minims; industrial methylated spirit to 20 fluid ounces. 2. Castor oil, 264 minims; mineral naphtha, 24 minims; ethyl phthalate, 192 minims; industrial methylated spirit to 20 fluid ounces.

10. **Peroxide of Hydrogen.**—The usual strength is 10 volumes of nascent oxygen, which is given off very easily; therefore the container should be tightly stoppered, and should be stored in a cool dark place. Diluted with equal quantities of warm water, hydrogen peroxide is useful for cleansing ears before packing with fresh dressings, or for cleaning wounds such as

the sockets of recently extracted teeth. A 10 per cent dilution makes an excellent mouth wash.

11. **Normal Saline.**—This lotion is very useful in 0·9 per cent strength, since this is the normal sodium chloride concentration in the body. It is used for dressings, irrigations, infusions and enemas.

12. **Other Stock Lotions.**—Depending upon the hospital or the medical director, there may be many additions to the above list.

Ethereal soap and Technical or Methylated Ether.—These are most inflammable substances and must therefore be stored in a cool place. They are used for cleansing.

Eusol, Dakin's solution, "Milton".—These owe their effect to the fact that they give rise to chlorine. They must be used only after being freshly prepared. They are used for irrigation, in the treatment of burns and for vaginal swabbing.

CTAB.—Cetyl trimethyl ammonium bromide. This is used as a 1 per cent solution for the skin and the hands, for douching and for burns.

Calamine.—Commonly used as a lotion for applying to the skin in cases of irritation and dermatitis.

"Dettol".—This is used for irrigating, douching, and vaginal swabbing, and in obstetrics. Similar lotions are "Superlin", "Osyl", "Supersan".

Lotions used for Skin Preparation.—These vary with the wishes of the surgeon, and the nature of the operation to be performed. Below is a list of those now in common use.

Iodine solution (liquor iodi mitis) 2 per cent ; acriflavine 1 in 1,000 ; merthiolate 1 in 1,000 ; gentian violet 1–2 per cent ; mercurochrome ½–5 per cent ; brilliant green ½–1 per cent.

Administration of Drugs

There are certain general rules which apply to the giving of drugs. In a ward, the doctor orders the medicine on a prescription form, and the preparation is delivered from the dispensary ; in private practice, the local druggist makes up the mixture or other remedy. In both cases the preparation is in the charge of the nurse, who in private practice must make her own arrangements for safe keeping of the drugs used. So far as the hospital is concerned, it is customary to have a medicine cupboard in one of the side rooms, and the key of this cupboard must be kept by a senior nurse. Even ordinary lotions should be "issued," as on many occasions simple mistakes have been made —for example, in the giving of phenol instead of castor oil, with fatal effect. Poisons may be kept in a special cupboard. In the case of drugs which come under the control of the Dangerous

Drugs Act (morphine, cocaine, heroin and others) a special book is kept in which is entered the amount of drug issued by the dispenser. When any one of these specified drugs is used, a separate entry must be made, with the patient's name, the date and the hour of administration ; the entry must be countersigned by a trained nurse. All poisonous fluids are marked with red labels on which is clearly printed the word POISON, and sometimes NOT TO BE TAKEN. The bottles are coloured green, dark blue or deep amber, and are frequently of hexagonal shape. If a poison thus advertised is given in error, it is essentially not the fault of the dispenser. But the nurse should never take risks ; it is the apparently impossible that always happens. A strict routine should therefore be observed at all times. The label should be carefully read, so that the name of the patient and the dose of the drug is checked. After carefully measuring out the dose, the nurse should once more check her work with the writing on the label. All medicines must be poured out with the label of the bottle uppermost; this avoids danger of obliteration of the directions on the label by drops. Before giving a dose to a patient, the nurse should get another nurse to check the amount ; this is especially important when large doses are ordered. Drugs should be given at the right time, not 10 minutes before, or 10 minutes after, the proper hour. The effect of the drug should be noted ; most patients dislike medicines however elegantly they have been compounded, and it is not enough to note how the patient criticizes his dose. What is important is the careful record of the signs noted afterwards. Many people have peculiarities towards certain remedies, such as potassium iodide and sodium salicylate ; increase of pulse, rash, running of the nose and various other manifestations must be carefully watched for.

Giving Drugs by Mouth.—The commonest way to give a drug or drugs is to dispense certain fluids or solids together in a mixture, as already described in Vol. II, p. 339. The dose is swallowed, passes from the stomach to the intestines and is absorbed there by the villi and so goes to the portal vein ; after a mixture has been taken, a drink served in a clean glass is always offered to the patient. All iron medicines should be taken either through a straw or glass rod or, if drunk, followed by a mouth wash since iron is harmful to teeth and dentures. Castor oil should always be warmed before use and given in a porcelain measure. It should be sandwiched between orange or lemon juice; when administered in its natural state dry bread and salt is given afterwards. A third method consists in beating up the castor oil with fruit juice and adding soda water. There are other ways of giving drugs by the mouth : the more common vehicles are pills, powders, cachets, capsules and tablets.

Pills have the advantage of being smaller to swallow than the

average dose of a mixture. But many people have great difficulty in taking pills and often the latter have to be incorporated in a bolus of bread. It is usual to coat pills with sugar, but in some cases this method prevents the breaking up of the pill at the right time, and many doctors prescribe pills in an uncoated state. On the other hand it may be necessary to delay the effect of the drug until it reaches a certain part of the bowel, in which case it is customary to coat the pill with a substance which resists the gastric juices, but which is digested by the succus entericus. Pills are very often used for their purgative effect.

Powders are usually small and are easy to take, apart from their taste. They are quickly washed down by a mouthful of water.

Cachets and capsules are made of rice paper or gelatine so that their contents can be liberated by the action of the gastric juice, which dissolves the envelope. The variety of tablets on sale nowadays is an indication of their popularity ; a stage has been reached at which competition is very keen among the drug manufacturers and refiners to produce ingredients of the purest type ; therefore it is certain that the public has a supply which is at its best. There are many other ingenious ways of introducing drugs into the alimentary canal, and the nurse learns many easy methods of making nauseating drugs less offensive to the patient.

Inhalation.—The various methods of allowing a hot vapour to reach the lungs have been discussed in Vol. II, pp. 345–349. Inhalation is used when a very speedy action is desired, as in the spasms of asthma or in the sudden constriction of the fine arteries in certain circulatory diseases.

Inunction.—For local and general skin diseases ointments, which consist of a fatty basis containing a certain drug, may be applied and gently rubbed in. Inunction properly means the rubbing into the skin of a certain amount of a drug incorporated in an ointment so that it can pass through to the subcutaneous tissues and be absorbed there. Mercury, a specific for syphilis, is commonly given in this way, and in some cases, cod-liver oil. The danger of mercury is that it may produce signs of mercurialism, in which there is ulceration of the mouth and gums with copious salivation. Therefore the nurse must avoid touching the drug herself, either by using rubber gloves, by using a flat glass applicator or by allowing the patient to rub the ointment in himself. Assuming that there is no broken skin, the following sites may be used during a week, so that there is no danger of causing permanent irritation: medial side of right arm, right side of abdomen, medial side of right thigh, medial side of left arm, left side of abdomen, medial side of left thigh. The skin should be carefully washed and dried before and after each

inunction ; the former procedure brings the maximum blood supply to the area and allows rapid absorption. A patient should be instructed to keep working the tips of the fingers steadily over the area for about half an hour ; this ensures that the drug is efficiently absorbed.

Drugs per Rectum.—In the rectal region, two methods are available—the fluid injection already fully described (Vol. II, pp. 355–361) and the introduction of the suppository. The latter is a cone-shaped portion of cocoa butter, in which is incorporated a certain amount of a drug, usually sedative in type. Since absorption from the rectum is poor, double the oral dose should be given. When the suppository is placed just inside the internal sphincter it melts, liberating the drug.

Ionization.—Zinc salts and iodide are commonly introduced to the tissues by the electrical method of ionization or cataphoresis. A pad is soaked in a certain solution of the drug and a current of electricity is passed through it for a certain time ; this deposits the ions of the drug. It is a method which belongs to the special branch of electrotherapeutics, but some doubts have recently been cast on its value.

Insufflation.—By passing a special insufflator, a fine powder is evenly sprayed over a part.

Drops.—By using a pipette drugs may be administered drop by drop to eyes, ears or nose.

Injection.—Injection is made by putting solutions of drugs into the tissues by means of small hollow needles.

Hypodermic Injection.—In giving a hypodermic injection into the cellular area under the skin, a special syringe and needle, familiar to all, is used. The all-glass or glass and metal syringes

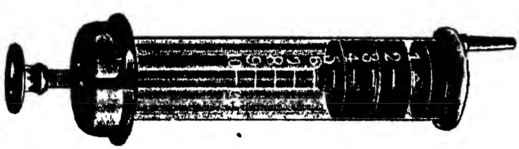


FIG. 20.—GLASS AND METAL SYRINGE.
(By courtesy of the Surgical Manufacturing Co., Ltd., London.)

are the most useful. The needles, which are rustless and which should always be kept ready for use in the metal box with a stilette in their canals, may be sterilized by boiling with the all-glass syringe, or they may be placed in methylated spirit for 5 minutes and then heated in a flame. In some cases the needles are permanently stored in methylated spirit. The all-glass syringe consists of 3 parts—a barrel, a solid glass piston, and a needleholder of glass which is ground on its upper circumference

so that it fits tightly into the barrel. When the three parts are properly fitted, the piston should just meet the upper surface of the needleholder, and both should meet at the point "o" on the graduated minim or cubic centimetre scale of the barrel. Before giving a hypodermic injection, the nurse should test the working of the whole apparatus very carefully.

So far as the routine of administration is concerned the following points should be noted. A tray should be prepared, containing small cotton wool pledgets, a 3 oz. bottle of ether or of methylated spirit, sterile water, the solution from which the injection is to be measured and a sterilized minim measuring glass. Sometimes liquor of iodine (mitis) is added to the tray.

The patient's skin, generally at the outer aspect of the middle of the upper arm, is cleansed with methylated spirit or ether, being rubbed well to ensure that all grease is removed. As an additional precaution, the skin may be swabbed with a 2½ per cent phenol pledget and allowed to dry.

The drug to be given may be taken from a bottle already prepared ; in this case the rubber cap should be swabbed with disinfectant solution before the drug is withdrawn. On the other hand it may be necessary to dissolve the tiny tablet in distilled water for this purpose ; here a watch glass, a minim measure (preferably conical) or a teaspoon may be used. After the solid matter has completely dissolved, the injection is ready for the syringe, but in all cases the nurse should have a check made by the sister or nurse in charge, as it ensures her freedom from liability and prevents mistakes. In the case of the solution already made up in bulk, and from which a certain amount has to be withdrawn, it is quite easy to have a check made after the dose has been drawn up into the barrel of the syringe. It must be stressed that all nurses must be quite certain of the correct dose, and in some hospitals the treatment card or case sheet is taken to the sister and initialled each time a dose is given.

During the above process, the syringe has been in boiling water in the sterilizer, and it is now all ready, but it must be tested. Incidentally it should be remarked at this point that care should be taken not to boil the syringe with the piston inside. The parts are fitted together, and a needle attached. A barrelful of sterile water is drawn up ; it should run freely, bubbling up into the vacuum left by the piston ; if it refuses to run two things are possible—1. a slack piston, 2. a choked needle. This is the reason why 2 needles are usually to hand.

There are 2 ways of putting in the needle. The nurse, whose hands must be carefully sterilized, takes the hypodermic syringe in her left hand, moves the piston slowly upwards until the liquid just appears at the end of the needle and then transfers the syringe to her right hand, gripping the barrel firmly with the

index and middle fingers, and pressing the thumb on the flattened end of the piston. With her left hand, she either pinches up the skin into a ridge, or draws it tightly over the muscle with the thumb and fingers. The needle is inserted boldly as far as it will go ; the patient feels a slight prick, but with a properly given hypodermic injection the pain should be momentary. The nurse slowly presses the piston, maintaining the pressure of the thumb until the whole of the dose has been given, then the needle is slowly withdrawn. Immediately afterwards the area should be massaged with a few firm strokes towards the heart to facilitate absorption. Unless this be done, there is a danger of leakage. Finally the puncture may be swabbed with phenol, spirit or iodine liquor (mitis), and a little varnish applied if necessary.

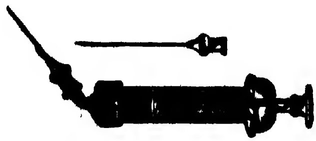


FIG. 21.—ANGLE-MOUNTED SYRINGE.
(By courtesy of the Surgical Manufacturing Co., Ltd., London.)

Care of Syringes.—The syringe and needle should then be carefully sterilized and returned to store. The care of syringes is important. The all-glass variety has the one disadvantage that it may be broken easily, but if it is remembered to dismantle the parts before boiling and to put them together only when cool, no accidents will occur. The metal and glass type is still much in use. The piston and ends are made of metal, the barrel only being of glass, but owing to the fact that the metal expands much more quickly than glass, there is a greater risk of breakage when the expanded metal is forced into the glass barrel. Probably more casualties occur from this than from anything else ; the nurse manages to push the plunger and piston in so far, then she finds it sticks and when she tries a little more force the glass barrel cracks.

Syringes are usually stored in alcohol or surgical spirit to which lysol has been added. The needles should have the stilettes replaced and can be kept in the same container. The advantage of this method is that everything is ready for use in an emergency. It should be noted that when penicillin is given by injection spirit must not be used for cleansing the skin or for the storage of the syringe. The syringe should be boiled after use and stored between the folds of a sterile towel ; the skin can be sterilized with CTAB. Care should also be taken to replace the stock bottle containing the drug, or alternatively the small tube of tablets. These should never be left near the patient.

Intramuscular Injection.—This is a method of introducing a drug deeply into a large muscle and is employed when heavy fluids like mercury and camphor are given. A larger syringe is used with correspondingly bigger needle, which should be long, sharp

and strong, so that it can be plunged deeply into the buttock or deltoid regions. Massage should be done for a few minutes after the dose has been given.

Intravenous Injection.—This may be very difficult when the veins are small. The usual veins chosen are the median cephalic or median basilic veins of the front of the elbow, a tourniquet being put round the upper arm to make the veins bulge as much as possible. This operation is usually done by a doctor. The needle is larger than the hypodermic needle, and after the area has been prepared in the usual way the point is pressed over the vein and sharply injected ; when it is certain that the tip of the needle is in the vein, and not before, the tourniquet is released, and the injection made as usual. Afterwards it is usually necessary to put on a small dressing and bandage. Salvarsan and its allies are given in this way.

Intrathecal Injection.—Intrathecal injection is discussed under Lumbar Puncture (see p. 54).

How and When to give Drugs.—Most patients object to their medicine but in all cases an attempt should be made to make the dose palatable. The old-fashioned method of giving a sweet after the medicine has been administered is still popular and effective. Castor oil has already been discussed ; in the case of paraldehyde the drug may be suspended in about an ounce of water, and an ounce of plain water should follow it. Most drugs are given after meals, but it is usual to give alkalis about 20 minutes before food so that they do not interfere with the acid of the digestive juices. Aperients are given often at bedtime and they generally have effect early on the next day. All the common saline purges should be given first thing in the morning, in half a pint of water. Some people take a large cup of weak tea about 15 minutes later, but another glass of plain water is equally effective. Saline purges act immediately after breakfast by producing a copious watery evacuation, the fluid of which has been extracted from the lower bowel ; the patient should therefore continue to drink plenty of water for the rest of the day. This is far more important than many people realize.

Preparation for Intravenous and Subcutaneous Infusions

In severe cases of haemorrhage and shock it is often necessary to replace the lost fluid and to raise the blood pressure by adding a large amount of saline liquid to the body. It is impossible to give this by the mouth ; the rectal method is too slow and therefore the speediest way to introduce the saline is by putting it directly into a vein or into the subcutaneous spaces.

Normal Saline.—This expression is familiar to all who have had any hospital experience. The solution is supposed to imitate as closely as possible the weak sodium chloride solution in which the tissues are bathed, therefore the strength is about 0·9 per cent. For ordinary use it may be made by dissolving 80 grains of pure common salt in a pint of hot distilled water. It may be boiled and cooled again before use. By using the correct strength it is made certain that no destruction of the blood corpuscles can occur; the solution is said to be isotonic with the blood. The most useful and most convenient way to keep saline is to have a stock of standard fluid in tightly stoppered flasks. When required, a flask is placed in water at a temperature of about 110° F., and allowed to warm up to 100° F., when it is ready for use. The stopper should be slightly loosened.

FIG. 22.—VACOLITER.

(By courtesy of Chas. F. Thackray Ltd., Leeds.)

Intravenous Infusion.—This is done by the doctor, but the preparation is the work of the nurse. In addition to saline, glucose (5 per cent) or gum acacia may be used.

Requirements.—The following sterile equipment: hypodermic syringe with 2 needles, cotton wool swabs, gauze swabs, dressing towels, French's needle, tubing, glass drip connexion, 2 gallipots, vacoliter, Horrock's saline infusion tube or reservoir containing the required fluid. The following unsterile equipment: spirit, tourniquet, padded splint, dressing mackintosh, strapping, scissors, stand for bottle, novocain 1 per cent, clip and 2 receivers for soiled articles.

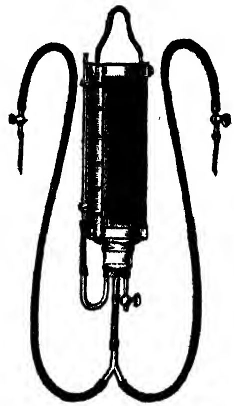


FIG. 23.—VACUUM APPARATUS FOR SALINE INFUSION.

(By courtesy of the Surgical Manufacturing Co., Ltd., London.)

If the vein is collapsed on account of old age or dehydration it may be necessary for the doctor to cut down into the vein and introduce a cannula instead of the needle. In this case there will be required in addition to the instruments listed above, a scalpel, dissecting forceps, artery forceps, aneurysm needle, skin needle, scissors, silkworm sutures, glass or metal cannula; all must be sterile.

The operation begins by a careful sterilization of the area chosen; this may be in the arm or leg, according to the vein

chosen. After the area has been locally anaesthetized, the tourniquet is fixed and the vein is made prominent. When the vessel has been identified, an incision is made, the vein is displayed and the tourniquet is taken off. Two catgut ligatures should now be tied round the vein, about an inch apart ; the upper knot is not tightened, but the lower one must close the vein. The needle or cannula is then placed in the vein through a small opening, and the upper ligature is tightened over it to keep it in position. The greatest precautions must be taken to prevent air from entering the vein ; this is done by having the saline all ready in the tube and needle. The saline should be allowed to run in slowly, at the rate of 30–90 drops per minute, as required. The temperature of the fluid should be kept at about 110° F., as it cools down to 100° F. in the slow process of infusion. When all the fluid is used up, the needle is withdrawn, the upper ligature is securely tied, and two silkworm sutures are put into the skin to close the wound, which is dressed with a dry dressing. In certain cases the limb is splinted so as to keep it well extended during the operation.

Subcutaneous Infusion.—The fluid used may again be normal saline or dextrose (6 per cent). Various sites may be chosen, the commonest being the area below the level of the nipples on the sides of the chest, but sometimes the abdomen is chosen, especially in infants, where the peritoneum forms a good absorptive area. On occasion the intermuscular septa are suitable.

The apparatus required is such that infusion can be done simultaneously on both sides. A glass syringe barrel, holding about 2 oz. of fluid, is connected to a 12-inch rubber tube, at the end of which is a Y-piece of glass tubing, each arm of the Y being connected by short rubber tubes to special curved hollow needles which must be strong and sharp. The usual disinfecting supply is necessary, as described above. A flask of saline should be kept heated, as the infusion is very slow. The whole area is painted with iodine after being carefully cleansed with spirit. The needles should be passed in an oblique direction, and deeply. Having made certain that the needles are both full of fluid, so that no air is allowed to pass, clamp the supply tube, and put the needles in. Release the clamp ; the fluid will pass comparatively quickly at the beginning ; the nurse must maintain a steady massage of the tissues all the time the fluid is passing so that it is absorbed by the cells. About half a pint of fluid is ample at each operation. It is advisable to cover the patient's skin, and to surround the funnel with cotton wool. To begin with the temperature of the first lot of fluid should be about 105° F., but when the saline begins to slow down, it may be necessary to raise the funnel temperature by another 10°, as cooling ultimately

reduces the fluid to 100° F. It should take about an hour to give half a pint. After the needles are withdrawn, a thin gauze and wound varnish dressing should be applied. The patient should be carefully observed in view of possible rigors.

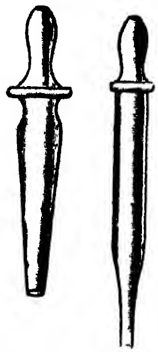


FIG. 24.—GLASS RECTAL AND WOUND PIPES.
(By courtesy of the Surgical Manufacturing Co., Ltd., London.)

Rectal Infusion

The absorption from the rectum is very slow; therefore in many cases of shock, severe haemorrhage, and abdominal inflammation, a continuous saline treatment by the rectum is given which may be in operation for about 3 or 4 hours. Water may be used, as it is more easily absorbed, but 6 per cent dextrose may also be given. There are two ways of giving rectal infusions, 1. the passage of so much fluid at certain periods; 2. the continuous drip method. Both of these have already been discussed in considerable detail in Vol. II, p. 360.

Blood Transfusion

Before blood is transfused, both the donor and the recipient must be tested for blood group. Incompatibility between the two will lead to serious complications. The donor's blood must also be proved to be free from organisms of malaria and syphilis.

Five hundred cubic centimetres are usually taken from the donor by inserting a large needle into a vein and receiving the blood into a bottle containing 50 c.cm. of 3·8 per cent sodium citrate solution to guard against clotting. This may be stored in a refrigerator ready for use, then inverted a few times and warmed to blood heat by standing in water.

The method of giving is much the same as for saline but a "gas mantle" filter is used to ensure that the blood will pass through without forming clots.

It is important that the rate of flow ordered is maintained and that the bottle is watched to see that it does not empty below the level of the short glass tube, as this will cause the transfusion to be stopped. Furthermore there is the difficulty of getting the flow commenced again, and there is the possibility that air might enter the vein—a dangerous complication. Careful precautions must be taken to maintain asepsis.

The benefit of blood transfusion is that, in contrast to saline, dextrose or gum, it conveys oxygen to the tissues as well as fresh antibodies which assist in fighting infection. This is very important when the patient is in a critical condition owing to loss of

blood. After transfusion, the patient must be carefully watched, since signs such as cyanosis, dyspnoea, a sensation of tightness over the heart or collapse may indicate that the transfusion has not been a success.

Venesection

If the blood pressure is too high e.g. in uraemia or in severe heart failure, blood may be drawn off from a vein. Although the old-fashioned method of using leeches is not yet given up, it is much slower in action. The procedure to be described is much the same as for intravenous saline infusion, or a 20 c.cm. syringe fitted with special intravenous needles may be used instead. Generally, however, the tourniquet is left on to increase the pressure in the vein, and the blood passes into a measured receptacle. One half to 1 pint may be withdrawn. The tourniquet is then removed and the skin is sutured and bandaged as described above. There may be transient lightheadedness of the patient, but it quickly passes off, and the general reaction is good.

CHAPTER 4

LOCAL APPLICATIONS

COLD LOCAL APPLICATIONS. ICE POULTICE. COLD COMPRESS. EVAPORATING COMPRESS. LEITER'S COILS. HOT LOCAL APPLICATIONS. DRY HEAT. MOIST HEAT. COUNTER-IRRITATION. MUSTARD POULTICE. MUSTARD PLASTER. MUSTARD LEAF. IODINE. BELLADONNA PLASTER. BLISTERING. CUPPING AND BLOODLETTING. DRY CUPPING. WET CUPPING. LEECHING.

Of the many local applications in use, only those of established worth are discussed in the pages which follow. The simple medical and surgical fomentations and the methods of applying ice in a bag have already been dealt with (see Vol. II, pp. 352–354 and p. 385).

Cold Local Applications

In addition to that of the ice bag, there are several ways of applying cold to a part, but the principle of each one is the same—to keep the temperature steady at a low index and thus to repair and soothe bruised, inflamed, congested or haemorrhagic tissues.

Ice Poultice.—The value of this application is in its lightness. It is very useful for application to the chest in cases of pneumonia, as it causes the minimum pressure. A piece of gutta percha tissue, a little more than twice the area of the region to be covered, is folded on itself. Over it is placed a layer, about half an inch thick, of absorbent wool, wood wool or splint wool; a margin of about half an inch should be left all round the gutta percha tissue. Crush a quantity of ice into small pieces each about the size of a Barcelona nut; spread the ice over one half of the wool and sprinkle it well with salt. Fold the other half of the lint and wool over the ice, and seal the 3 free edges with chloroform or turpentine applied with a camel hair brush. When the ice requires to be renewed, it is a simple matter to cut the seal on one border with scissors, refill the envelope and seal up again. Lint or flannel may be used to cover the poultice before it is applied to the part.

Cold Compress.—This is used for the head or for the eye, and

the success of it depends upon the steady maintenance of the low temperature at the affected spot. The nurse in charge must therefore be prepared to make frequent and rapid changes. For this reason the compress is very lightly fixed by a single or double turn of a bandage, and there should be an enamel basin containing ice, set in a larger one containing a freezing mixture, at the bedside. To make an ice compress, a triple layer of surgeon's lint should be immersed in the ice cold water in the basin. Without delay, it should be well wrung out and fixed over the affected part, covered with jaconet and bandage.

Evaporating Compress.—For this only a single layer of lint is necessary, and it need not be covered but it can be tied on or fixed with plaster at the edges. Owing to the leakage of fluid, it is advisable to put a mackintosh covered by a towel below the part under treatment. The principle of this treatment is the maintenance of a cold area by the evaporation of spirit or other lotion ; therefore a bottle of the lotion should be kept handy and the lotion should be poured over the lint as soon as it loses its moisture. On no account should the lint be covered. This is the common treatment for headaches, a lotion being made up consisting of 25 per cent alcohol in iced water, together with a little eau de Cologne or lavender water.

Leiter's Coils.—Leiter's coil consists of lead tubing, lightly bound together by thin webbing. The more modern form is Thornton's spiral ice bag (Fig. 25). The coil can be moulded to any part e.g. the head, for which it forms a kind of bonnet. The upper end of the tube is joined to a rubber tube which may be attached to a douche can or dipped into a pail of iced water well above the patient. The lower part of the tube leads into a bucket which stands on the floor. To circulate the cold water, it is necessary to strip the upper rubber tube, then allow the water to rush in and then adjust the tap or clip. Circulation is a process of slow siphonage, and when the lower bucket is full the buckets may be reversed if the water is cold enough. A strip of flannel should be interposed between the coils and the part under treatment.

FIG. 25.—THORNTON'S SPIRAL ICE BAG FOR THE HEAD.
(By courtesy of the Surgical Manufacturing Co., Ltd, London.)

Hot Local Applications

Heat may be applied to the human body as moist heat or as dry heat although the former is to be preferred.

Dry Heat.—Hot water bottles are the commonest sources of dry heat ; they must be suitably protected by a flannel cover. Electric pads and blankets are very useful media for the supply of dry heat. They are now in increasing demand and use (see Vol. II, pp. 314–316). Cradles are extensively used to heat beds ; electric lamps are suspended from the framework and the amount of heat can be regulated.

Moist Heat.—Medical and surgical stupes have already been dealt with (Vol. II, pp. 352–353). The turpentine stupe, already referred to briefly, and other methods are discussed below.

1. *Turpentine Stupe.*—This is simply a medical fomentation to which is added half an ounce of turpentine for an adult and about half a teaspoonful for a child. The turpentine is evenly sprinkled on the flannel before the water is poured over it, or alternatively the turpentine is mixed with olive oil and actually smeared over the skin and a medical fomentation applied immediately afterwards to cover the area. Care must be taken to ensure that the reaction is not too great ; it is the duty of the nurse in charge to lift up the edge of the flannel after 3 minutes and find out if there is any undue reddening of the area. In any case a turpentine stupe should not be left on for more than half an hour in the case of an adult and 10 minutes in the case of a child. This is a very important point, as the turpentine stupe is often employed to relieve abdominal pain, and the skin of the abdomen is very sensitive. After the stupe is taken off hot dry cotton wool or a plain medical fomentation should be applied in its place.

2. *Medicinal Stupes.*—These are frequently applied in general practice to soothe a painful sprain or similar condition. Opium, lead and opium or belladonna are commonly used drugs. The stupe is first wrung out in hot water, then ½–1 drachm of tincture of opium, lead and opium lotion or tincture of belladonna is sprinkled on the flannel, after which the fomentation is applied in the usual way. In some cases a special shape of flannel must be cut to fit the affected part, or a succession of small squares applied until the whole area is covered.

3. *Poultices.*—Poultices are not used so extensively as they were 50 years ago, and for all practical purposes the bread poultice has died a natural death.

Linseed poultices are, however, required in certain circumstances. To make a linseed poultice the following are required: poultice board, spatula, enamel basin, enamel jug containing boiling water, 2 hot plates, wringer, poultice cloth, gauze, wool, jaconet, binder, safety pins, supply of linseed and kettle of boiling water. Everything should be as hot as possible in order to avoid heat loss. Linseed meal in which the seeds are crushed to a fairly fine granular powder is the best agent. A quantity of

boiling water is put into the basin, and the linseed meal is added in a way similar to that adopted in making oatmeal porridge, the spatula stirring it all the time. When a thick paste has been obtained, generally in the proportion of 3 parts of linseed to 1 of water, the mass should easily come away from the sides of the basin, and should cut clean like a lump of soft putty. It is important to have the right consistence, since linseed contains valuable oil and its heating properties are at their best when the poultice is not too soft. The material on which the poultice is to be spread may be of flannel, linen or teased tow, the last carefully pulled out until it forms a thin pad. The paste is transferred to the cloth on the board, and the hot spatula is used to spread out an even layer, about half an inch thick and extending to within an inch of the margin of the cloth all round. Gauze may be laid over the upper surface, and the edges should be folded in. The poultice should be taken to the bedside between hot plates, and it should be applied as hot as the patient will bear ; he usually objects at first, but gradually becomes used to the heat especially when it is explained to him that the hotter the poultice the better will it have effect. It is well to rub the skin previously with a little "Vaseline" and boric acid. In changing poultices the nurse must remove the old one quickly and apply the new one at once, so that the area does not have time to cool. The poultice may be retained in position by flannel binders or bandages, applied over cotton wool and jaconet in a manner similar to that of the medical stupe. Children require thinner poultices but adults reap the most benefit from thick poultices, except when the jacket poultice is used and spread over a large area, as its name implies. Linseed should never be applied to a broken surface unless in the charcoal poultice, which is a linseed poultice applied to a discharging ulcer or other offensive wound and made by sprinkling powdered charcoal (1 : 3) over the paste. In many cases, the covering of gauze is unnecessary in the plain linseed poultice, the mass being applied directly to the skin ; if the paste has been properly made, the linseed should not stick owing to the oily nature of the meal. Generally speaking, a poultice should be left on for 4 hours, but in many cases the change is made more frequently, especially when the condition is acute.

4. *Clay Applications.*—Various preparations of clay are used, but one example—that of antiphlogistine—will suffice. Antiphlogistine contains methyl salicylate and is supplied ready for use in a tin. The poultice must be heated first. This is best done by standing the tin in a saucepan of water over a small gas jet. Before antiphlogistine is applied it should be stirred to ensure that the heat has penetrated thoroughly.

Spread the mixture evenly on a piece of lint (not the woolly side) to a depth of about half an inch, cover with warmed cotton

wool and fix by using a domette bandage. This application should be renewed every 8 hours. As an alternative cataplasma kaolin co. can be used ; this also contains methyl salicylate as well as glycerine, thymol and aromatic oil.

5. *Starch Poultice.*—This is used to remove dried crusts of skin. Mix the required amount to a smooth paste with cold water ; if desired borax may be added. Then add boiling water and leave to cool so that a jelly is formed. Apply by using old linen previously damped (this makes the starch adhere more tightly) and cover with gauze. The starch poultice may be covered with jaconet if wished. For the face it is often useful to cut the linen in the form of a mask, leaving slits for eyes and nose and mouth. It must be gently removed to get off as many scabs as possible but not to tear them off.

6. *Scott's Dressing.*—This is a preparation containing olive oil, mercury and camphor. The ointment requires to be warmed before use as in the case of kaolin applications. It is then spread on strips of old linen up to 2 inches wide and applied direct to the skin, each strip being slightly longer than the circumference of the joint designated. The strips are crossed over each other on the outer side of the limb. Each strip overlaps the former by about ½ inch. The strapping is applied in the same way until the joint is covered, plus about 3 inches above and below. A cotton bandage is put on the outside to protect the patient's clothing, as mercury stains badly. The whole application is renewed weekly. It is a most useful treatment for inflammation of a joint, and for this reason must be very evenly applied.

7. *Unna's Paste.*—This is a preparation containing zinc and gelatine. The putty-like squares are melted in a pot standing in boiling water. The limb must be shaved ; the paste is applied directly to the skin by a camel-hair brush and covered with a layer of gauze or a cotton bandage. This procedure should be repeated until the limb is covered to the desired thickness (about 3 applications usually) ; the dressing is left on for about a week. It is most useful in the treatment of varicose ulcers. "Elastoplast" can be put over the top dressing if needed.

Counter-Irritation

The action of a counter-irritant is one of local stimulation. Counter-irritants are used because they act very quickly, are powerful in effect and have a wide influence beyond the point of their application. They are therefore useful when we wish to relieve deep congestion. The irritation of the sensitive skin nerve bulbs causes a dilatation of the peripheral vessels and much of the blood pressure is removed from deeper structures ; at the same time the lymphatic absorption is stimulated to the

maximum, thus much waste fluid is got rid of. Apparently there is a subconscious effect on the individual, attracting his attention to the superficial structures as against the deep structures and thus bringing relief to internal pain. In some cases the counter-irritant is applied directly over the area of the deep-seated pain but it can be equally useful in an indirect way e.g. when applied to one part of nervous distribution in order to ease other inaccessible parts of the same distribution ; when applied to a group of superficial vessels in order to relieve distant congestion ; or, if there is a need for absorption of lymph from an inflamed joint, when the area round the joint is painted or blistered. Some irritants merely cause a blush or deep reddening, in which case they are known as rubefacients. Stronger agents cause blistering, and are known as vesicants ; a few lead to pustule formation and are known as pustulants. Examples of these are described below.

Mustard Poultice.—The mustard poultice contains anything from 1 part of mustard and 5 parts of linseed to 1 part of mustard and 9 parts of linseed. Linseed is prepared for a poultice in the usual way. The quantity of mustard required is made into a paste with tepid water and then carefully mixed up with the linseed. The skin must be well rubbed with soft paraffin and boric acid and a layer of gauze should be interposed between the poultice and the skin. The duration of application is never greater than 20 minutes and after the poultice is removed it is necessary to dust the skin well with talcum powder and protect it with cotton wool for a few days. This is a typical rubefacient and it should not blister, but a deep red blush should mark the site of the poultice for some hours. Care should be taken that the mustard is completely removed, as a local and general effect may be caused by the leaving of a few grains which give rise to a very irritating oil when left damp in the air.

Mustard Plaster.—This is made with flour and is sometimes termed the mustard poultice proper, since linseed is not used. It can be made up in varying strengths, beginning with a half and half mixture which is very powerful. It may be very effective in deeply seated pain. The strength of mustard can be varied according to the requirements of the case. A weaker plaster can be left on for a longer period than can the 1 in 1 plaster, which is rarely left on for more than 20 minutes. Common strengths are 1 in 3–6 for adults and 1 in 12 for children. The flour, mustard and water are made into a paste by working with a spatula and using tepid water The mass can then be transferred to the time-honoured vehicle—brown paper—or to gauze or to linen. The skin should be carefully cleaned and then oiled as usual. The plaster should be covered with a layer of gauze before application ; it is folded in exactly the same way

as the linseed poultice. The usual care should be taken with the skin afterwards. Sometimes 10 minutes is quite sufficient for the application ; much depends upon the patient's reaction

Mustard Leaf.—This is a handy preparation, obtainable at all druggists' stores. It is not entirely dependable, however, as it varies a great deal in its action and before applying a mustard leaf it is advisable to try a small sample on the patient's skin. In any case, the application of a layer of gauze is usually necessary over the skin to avoid the actual contact of the mustard leaf. In the tin the leaf is dry but before use it should be soaked in tepid water until it is sodden, then it can be applied as above. A period of application of 10 to 20 minutes is usually sufficient time. The after-treatment follows the routine of all mustard applications.

Iodine.—This is a drug which may be a rubefacient or a vesicant. One coat of the liquor iodi mitis of the *B.P.* may result in a blush which lasts for some time ; several coats may eventually cause mild blistering ; but a coat of the strong (10 per cent) liquor may raise large blisters very soon. Iodine is very largely used in an indiscriminate way by the general public, who regard it as the cure for all external ills. It has the advantage of being an antiseptic as well as a counter-irritant. Iodine should be applied with a small pledget of fine gauze (not cotton wool) or with a camel hair brush. If two or more coats are ordered, it is essential to wait until the first dries and becomes deep brown before applying the second. If a definite area must be covered, it can be ringed with "Vaseline" or blotting paper. After the application, the area should be dressed with gauze and cotton wool.

Belladonna Plaster.—This is supplied by the druggist. It may be used to reduce the secretion of milk in a nursing mother or to relieve myalgia, but care must always be taken that the subject is not peculiarly susceptible to belladonna, this being indicated by a vigorous reaction in the first few hours, characterized by dryness of the mouth and throat, hot skin, absence of sweat and large pupils. If there is no complication, the plaster can be left in position for several days. It is made of adhesive material and is prepared by holding it against a jug of hot water. It is then firmly pressed on the chosen area.

Blistering.—There are many ways of producing blisters. Vesicants vary in their reactions, and there is a wide range to choose from. But when a blister, or a fly blister, is referred to, the official pharmacopoeial agent is meant viz. cantharides, the active principle of Spanish fly. This substance can be used as a plaster or as a blistering fluid. In the former case, the skin is carefully cleansed, shaved if necessary, and all traces of

grease removed by alcohol or ether. Then a circular disk of the plaster is cut according to the area for which it is required ; most plasters are marked in 1-inch squares, which is usually quite enough for the irritation desired. The plaster is put on, and the covering of thin cotton wool is lightly and loosely fixed by adhesive plaster, so that there is room for the blister to rise. A good plan is to cover the cotton wool with oiled silk neatly pleated and fixed at the edge by strapping ; as the blister rises, the pleats open out. If after 6 to 8 hours there is not any blister, a hot fomentation may cause it to rise.

There may be orders to leave the blister unpunctured, in which case it is treated by dry dressings until the fluid is absorbed, and the skin can be peeled off in a few days. In most cases, however, the bleb is punctured at its lowest part with fine sterile scissors, and the fluid may be saved for examination. The punctured blister may be dressed regularly with zinc ointment or with sterile gauze, but care should be taken not to let the serum escape on to good skin as traces of blistering agent may still be present. Air should also be allowed to reach the area through the dressing as this facilitates evaporation.

When blistering fluid, officially known as liquor epispasticus, is used, the area is encircled by a ring of "Vaseline" and the paint is applied in 2 coats. When dry, the area is dressed in the usual way. Care should be taken that the paint is completely removed before the blister is punctured. Cantharides is contra-indicated in kidney disease.

Cupping and Bloodletting

Mechanical methods of transferring the blood from the deeper parts of the body to the surface, with or without actual withdrawal of the blood from the body, have long been in use apart from venesection. The three common methods are dry cupping, wet cupping, and the application of leeches.

Dry Cupping.—By this method, blood and other fluids which are congesting deeply-seated tissues or organs such as the heart, liver, kidneys and lungs, are transferred to the superficial vessels underneath the skin ; sometimes cupping is used to relieve lumbago.

For dry cupping the following appliances must be assembled at the bedside : a tray, on which are set about 12 cupping glasses ; "Vaseline"; methylated spirit; sterilized blotting paper; matches. "Vaseline" is carefully applied to the edges of the cupping glasses and a small piece of blotting paper, saturated with methylated spirit, is placed inside the cup. The paper is set alight and immediately the glass is pressed firmly over the area to be treated. The burning of the paper goes on for

a moment while the air lasts, then a vacuum is created and the skin is drawn up into the glass, holding it in position firmly. The tissues may become deep red or purple and must not be left in the cup too long. Generally about 5 to 15 minutes is quite satisfactory. In order to remove the glass, it is necessary to press the thumbnail on the skin at one side of the glass ; this allows the air to rush in, and the cup quickly springs off. Cups must never be pulled off by brute force. In some cases it will be found that a certain amount of effusion has been withdrawn into the cup. Several cups may be applied at one time. When cups are not available, a wineglass forms a good substitute. The more modern type of cup is represented by Bier's suction apparatus (Fig. 26), which consists of a glass bell at the top of which is an opening connected to a rubber tube and hand suction pump. As the air is pumped out of the bell, the tissues rise, and in cases of carbuncles on the back of the neck for example, the pus is sucked out most successfully.

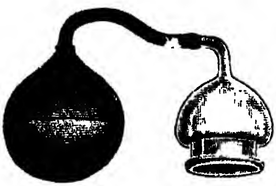


FIG. 26.—BIER'S SUCTION APPARATUS.
(By courtesy of the Surgical Manufacturing Co., Ltd., London.)

Wet Cupping.—Wet cupping is really an artificial method of leeching, described below. After careful disinfection of the area, a dry cup is applied for a few minutes, then the skin is scarified lightly with a small lancet or scarificator, a second cup being applied immediately afterwards. A sterile dressing must be put on when the treatment is finished.

Leeching.—The leech is surely one of the most interesting members of the pharmacopoeia ; for centuries this animal has been employed to draw off excessive blood from the human body, and no doubt it was much more required in bygone days of gluttony and increase of blood pressure. Leeches are still used now and then. Owing to the fact that they produce a substance which prevents the clotting of blood, they should never be applied over a soft, fleshy part or near a blood vessel. The best site is one at which there is a thinly covered bone.

The leech has usually to be humoured before he will consent to perform ; he objects to any strong scent, and therefore in the routine cleansing of the skin which is necessary, perfumed or disinfectant soap must be rigidly avoided. The skin is most attractive when it has been well rubbed with soap and water, then thoroughly rinsed with plain water and left moist. The area is covered by a piece of lint in which holes are cut to allow the leech to bite ; slimy parasites such as this should never be felt by a patient. Leeches object to being handled, thus although

some people have success in applying leeches with forceps or lint, the best way is to fill a test tube nearly full with cotton wool, then to place the leech broad end downwards into the tube, and to tilt the tube so that the suckers come in contact with the skin. If the leech is still shy, a drop of milk or of moist sugar may be put over the area. Once it has begun to feed it will require no further coaxing ; anything from 1 to 3 teaspoonfuls of blood may be drawn off. In eye surgery, leeches are useful to relieve congestion ; 3 may be placed in a row above the eyebrow. It is not often necessary to remove the leech forcibly, as it sucks for nearly an hour and then drops off somewhat dazed and replete, but if it is too tenacious it should be touched with a little common salt at the head, when it will at once relax its hold. Sometimes the bleeding continues after the leech has been removed and it is well to apply a styptic to the typical triangular incision left by the mouth. As a rule, leeches are destroyed immediately after use by placing them in 5 per cent phenol, but if they must be kept, they are made to vomit the blood by putting them in a strong solution of common salt. All nurses should remember that patients shrink from contact with such creatures, and when possible the leech should be covered by lint or gauze, but it should be ascertained from time to time how the withdrawal of blood is proceeding. After the operation is over, a fomentation is sometimes applied when more blood is required, but usually bleeding goes on well owing to the hirudin secreted by the animal and it may be necessary to apply adrenalin pads until clotting is re-established. A sterile dry dressing should complete the operation. In all leeching procedures, the nurse must remember not to alarm the patient. Indeed, nervous patients have sometimes to be blindfolded.

CHAPTER 5

REMOVAL OF SUPERFLUOUS FLUIDS

ASPIRATION. EXPLORATORY PUNCTURE. ASPIRATION BY POTAIN'S METHOD. TAPPING. SOUTHEY'S TUBES. LUMBAR PUNCTURE. HOW TO MAKE A LUMBAR PUNCTURE. CATHETERIZATION. PASSAGE OF THE FEMALE CATHETER. MALE CATHETERIZATION. IRRIGATION OF THE BLADDER.

In normal circumstances the amount of fluid in the tissues of the body is kept at a steady level by the action of the various excretory systems—urinary, alimentary, respiratory and the skin. When for some local or general reason one or more of these cease to perform their function to the full, fluid collects in the tissues, which become waterlogged and therefore require to be drained. The various methods of getting rid of the accumulated fluids, apart from the use of drugs, are fully discussed in order below.

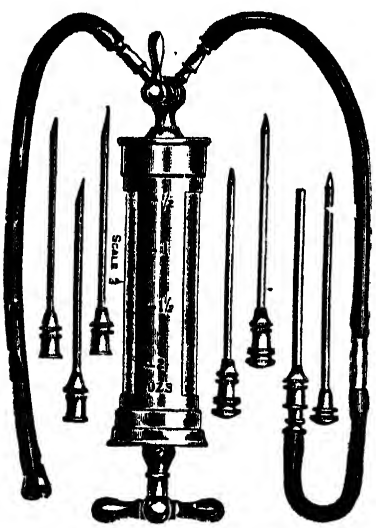


FIG. 27.—DIEULAFOY'S ASPIRATOR.
(By courtesy of the Surgical Manufacturing Co., Ltd., London.)

Aspiration

Strictly speaking, the word aspiration is used to denote in Medicine the withdrawal of fluid or pus from the pleural cavity, but it has gradually become more comprehensive in its application and now is taken to include the removal of unwanted secretion from any cavity or space in the body.

Exploratory Puncture.—If the doctor discovers by routine physical examination of the chest a pocket of fluid which remains

despite vigorous conservative treatment, he may decide to make an exploratory puncture by using a large hypodermic syringe. By this method he is enabled to draw off a sample of the fluid, and have it examined and reported upon by the pathologist. After the nature of the fluid has been determined, further treatment can be adopted on the most suitable lines.

Making an exploratory puncture is even more demanding of the most careful aseptic precautions than ordinary hypodermic injection. The small pleural cavity is very sensitive and quickly reacts in a very dangerous way to organisms; therefore the nurse, in her preparation of the instruments and her care of the patient, must be punctilious to a degree. She will not be asked to do the operation but she will be trusted to have everything germ-proof.

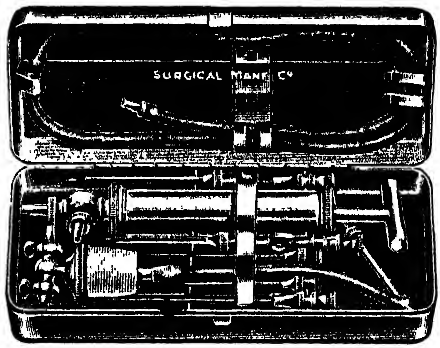


FIG. 28.—POTAIN'S ASPIRATOR.
(By courtesy of the Surgical Manufacturing Co., Ltd., London.)

All the apparatus must be ready for the doctor: an all-glass record syringe, usually of medium size; several needles of various bore; spirit, ether and iodine for the skin; sterile gauze and wound varnish for the subsequent dressing; ethyl chloride in spray phial or other local anaesthetic of the doctor's choice. Two sterile test tubes, carefully plugged with sterile cotton wool, must also be in readiness for the specimen about to be withdrawn.

Aspiration by Potain's Method.—The requirements for this operation are: Potain's aspirator complete (see Fig. 28); the usual skin cleansers and disinfectants; dressings; hypodermic needle with local anaesthetic; cotton wool; kidney tray; sal volatile or brandy; 2 sterile test tubes.

The whole procedure must be carried out with as strict asepsis as at a major operation, and it is always directed by a qualified medical man. Before the Potain's aspirator is used, a thorough test must be made. First the parts must be carefully put together; the bottle and its rubber cork, freshly sterilized, are fitted with the 2-way metal tube which passes through a hole in the centre of the cork, and which has a tap on each arm; the air pump is tested; the cannulas and their trocars, of various sizes, should all be proved to be in good working order. Often the whole apparatus is first put through a preliminary test with sterile water.

The patient should be placed either in the semi-recumbent position or lying on the sound side, with a pillow below him. It is better to keep the head low or to have things arranged so that the head can immediately be lowered, because fainting is quite common when the fluid is taken away from the pleura ; the brandy should be ready for this emergency. It is best to have the arms drawn well above the head, so that the whole of the lower axillary area and the outside wall of the chest are freely accessible. The surgeon may choose the 5th, 6th or 7th intercostal space in which to insert the needle ; therefore the nurse should have a wide area of the skin in sterile condition. When all is ready the chest is sprayed with ethyl chloride or injected with novocain.

The aspirator works on the principle that if a vacuum be created in the bottle and the stopcock on the chest side suddenly opened, the fluid will be sucked into the bottle. The bottle and cork with attached air pump and special aspirating trocar and cannula are therefore dealt with as follows. The air is withdrawn from the bottle by closing the tap on the chest side and opening the tap on the pump side. After a sufficient amount of air has been withdrawn from the bottle the tap is shut ; therefore inside the bottle is a vacuum. Now the trocar and cannula are carefully passed into the pleura ; the trocar is withdrawn and the tap on the cannula is closed. When all is ready, the tap on the arm above the cork is opened ; this leaves a clear way from the pleural cavity to the bottle and, the pressure in the pleura being greater than that in the bottle, the fluid is sucked into the bottle. To be a success there must be no possibility of leakage, hence the need for carefully checking over the rubber connexions and all other fittings. It is also essential to prevent the entrance of air into the pleural cavity. Immediately the quantity of fluid considered ample has been withdrawn the trocar is removed and the area is dressed as above, but the general condition of the patient is like that of mild shock. He therefore requires to be watched for an hour or two, being well covered up, given stimulants and supplied with hot water bottles. A specimen of the fluid withdrawn is placed in the sterile tube, labelled and sent to the pathological laboratory. The remainder is measured before being thrown away. After use the whole apparatus is very carefully washed in cold water, then sterilized.

Tapping

This procedure is resorted to chiefly for taking fluid from the abdomen. It can be done with simple trocar and cannula in conditions of chronic peritonitis with effusion (paracentesis

abdominis), of large ovarian cyst or of hydrocele. For abdominal conditions the bladder must be emptied first, either naturally or by catheterization, and the trocar and cannula are usually inserted through a minute incision made in the previously sterilized skin of the abdomen at a point about 2 inches below the umbilicus. The patient should be in an upright position, with a binder round the abdomen. Care must be taken that the escape of the fluid is not too precipitate, as the sudden relaxation of internal pressure often leads to collapse. Stimulants should be at hand as for aspiration. Great care should be taken to avoid soiling the clothing with the escaping fluid, which is usually received into a kidney basin. The cannula should be kept in position by a sterile strip of gauze. In some cases the drainage trickles on for a day or two; this demands that the cannula be fixed securely ; the drainage tube should pass into a receptacle containing phenol (1 in 40). As the abdomen empties, the binder should be gradually tightened this is a point of great importance in the comfort and equilibrium of the patient, as well as in the expeditious removal of the fluid. It may be necessary to take off the fluid by degrees. In most cases judgment is made according to the general reaction of the patient. Southey's tubes, described below, are sometimes used for abdominal tapping.

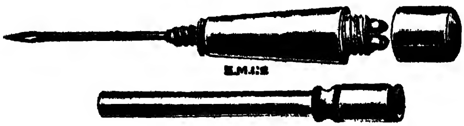


FIG. 29.—SOUTHEY'S ANASARCA TROCAR.
(By courtesy of the Surgical Manufacturing Co., Ltd. London.)

Southey's Tubes.—These are very minute rubber tubes fitted to a perforated silver cannula of extremely small bore and provided with a flat, shield-like guard to help its retention under the skin (see Fig. 30). In drainage by this method, the oedema of chronic heart and kidney disease may be relieved and the process can go on by very slow leakage. The lowest parts of the body—e.g. the ankles—are commonly chosen for the operation. After the usual preparation of the skin the patient is placed either sitting up in bed or on a chair with the legs hanging down. The cannulas are kept in position by sterile adhesive plaster for several hours and the long rubber tubes lead into sterile

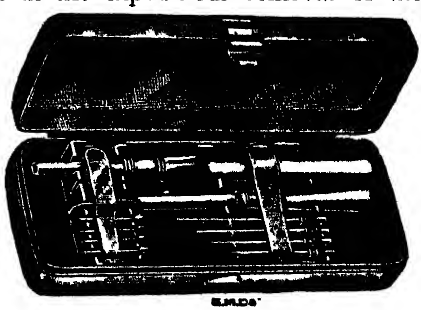


FIG. 30.—SOUTHEY'S TUBES.
(By courtesy of the Surgical Manufacturing Co., Ltd., London.)

water or phenol (1 in 40). When the patient is treated in bed, the sheets and other bedclothes must be protected by mackintoshes, and cradles should be provided to take all pressure off the limbs, which are carefully rolled up in sterile dressings and bandages. Final dressings are applied as usual.

Lumbar Puncture

It will be recalled that the brain and spinal cord are surrounded and bathed by the cerebrospinal fluid. This fluid may become abnormal when the brain or spinal cord is diseased or when the membranes surrounding them are inflamed. Cerebrospinal fluid is drawn off by the process of lumbar puncture for one or more of the following reasons.

1. When the pressure of the cerebrospinal fluid is increased owing to the quantity being excessive. This is found in meningitis, or inflammation of any portion of the meninges. The brain and spinal cord are literally crushed, and headache, unconsciousness and a varying degree of paralysis are produced.

2. In order to find out the condition of the fluid, and to ascertain whether certain cells and bacteria are present.

3. In order to inject an antitoxic serum for certain diseases which affect the brain or spinal cord.

4. For the production of spinal anaesthesia, a method now chosen by surgeons in certain operations.

How to make a Lumbar Puncture.—As with aspiration and tapping very strict aseptic methods must be employed. The patient lies on one side in a curled-up position, with the back curved as much as possible ; the knees should be drawn up and the head bent over the chest to the maximum extent. In some cases the patient sits upright and bends as far forward as he can. In either case the area for puncture is freely exposed, viz. the space between the 3rd and 4th lumbar vertebrae. The appliances required are exactly the same as for aspiration, except that the aspirator is replaced by a special lumbar puncture needle. The local anaesthetic must be allowed a few minutes to have effect, then the needle of the puncture instrument is boldly inserted a little to the side of the interspace, and it should pass right into the spinal canal ; little or no danger can occur to the cord at this spot. After the requisite amount has been withdrawn, the puncture is sealed as usual and the patient is kept without pillows and very quiet for the next day. When serum is given, a quantity of cerebrospinal fluid should first be withdrawn equal to the amount of serum to be given, then the dose is slowly injected. Afterwards the patient should be kept with the hips supported by pillows, the foot of the bed

raised and the head low, so that the serum will travel up the spinal canal.

Catheterization

As already described (see Vol. II, pp. 387–388) a catheter is a steel, silver, plated, gum-elastic or rubber tube with a blunt end having an inlet at the side, and is passed via the urethra in both sexes into the bladder. Urine can thus be removed when necessary, and in a way different from that of normal reflex action. Rarely if ever will a nurse be asked to pass a catheter on a male patient, since owing to the length of the urethra and the difficulties of its course a doctor almost invariably does this himself. But the female urethra is short and easily traversed and there is little or no difficulty in emptying the bladder.

Passage of the Female Catheter.—Two short rubber female catheters, free from cracks or obstructions and carefully sterilized, are prepared. Sterile cotton wool swabs, 2 sterile towels, lotion for swabbing e.g. "Dettol" (1 drachm to 1 pint), a receiver for the urine, a bucket for soiled dressings, a mackintosh sheet and towel, are other requisites. The one lesson that must be learned by nurses is that once microbes obtain a foothold in the bladder, they may settle down there for years and make the patient's life miserable owing to chronic cystitis. Therefore it must be stressed that not only the instruments and appliances, but the patient's skin in the region of the urethra and the hands of the nurse, must be scrupulously clean and free from all possible sources of contamination. In most cases 2 nurses are required to carry out the treatment successfully.

The best position for the patient is on her back with the knees drawn up ; one pillow is sufficient for the head. The mackintosh and towel are spread out below the buttocks. The thighs are placed conveniently apart, but in order to prevent cold it is well to drape a blanket over each thigh.

To make sure of freedom from sepsis the preliminaries are best done by the first nurse, while the second actually passes the catheter ; but if only one nurse is available, she should never pass the catheter without vigorous cleansing of the hands after the area has been prepared.

The nurse should stand on the right of the patient ; with her left hand she separates the labia majora, which are cleansed carefully, then the labia minora are similarly treated. The work must be done always from above downwards, so that no discharge from the vagina or anus reaches the urethral orifice. A new pledget of cotton wool, soaked in the "Dettol" solution, should be used at each stroke. The operation of inserting the catheter is done by taking the open end in the right hand, while

CHAPTER 6

BATHING AND SPECIAL BATHS

COLD AND HOT BATHS. TYPES OF BATH. MEDICATED BATHS. MUSTARD BATH. EMOLLIENT BATH. ANTISEPTIC BATH. ALKALINE BATH. FOOT, ARM AND HIP BATHS. SPONGING. COLD SPONGING. HOT SPONGING. PACKS. COLD PACK. ICE CRADLING. HOT WET PACK. HOT DRY PACK. RADIANT HEAT. HOT AIR. VAPOUR BATHS.

THE subject of bathing has already been dealt with, as it affects the patient who is bathed as a routine on entering the hospital, or who is given a blanket bath (Vol. II, pp. 292-295). Bathing must now be considered from the point of view of therapeutic effect; the use of hot and cold water, ice, heat, hot air and vapour in certain diseases must also be discussed.

Cold and Hot Baths

From a purely hygienic point of view the hot bath is a cleansing agent, removing the fine layer of grease, laden with bacteria, which quickly gathers on the skin. Baths may be used at various temperatures and in some cases certain drugs may be added. Other functions of the bath are the adjustment of the temperature of the body, the stimulation of perspiration, soothing and tonic effects, relief of pain and the development of the desire to sleep.

Types of Bath.—Four main types of bath are described according to the temperature : 1, cold bath—50°–70° F. ; 2, tepid bath—80°–90° F. ; 3, warm bath—90°–100° F. ; 4, hot bath—100°–110° F.

Cold baths are essentially associated with the healthy state and rarely come into modern nursing routine. It should always be remembered that to plunge a nervous or very sick patient into a cold bath is at any time a dangerous proceeding ; even in health cold baths cannot be tolerated by all.

When the temperature of the bath is about 95° F. there is produced a soothing and cleansing effect and this helps to give relief

from pain. A brisk rub down afterwards assists the circulation and promotes sleep.

Medicated Baths

There are various types of medicated bath in use. The present Chapter does not include reference to the numerous bathing establishments found at spas and health resorts and which depend often upon the local minerals found in the water. We can deal here only with certain common types of bath which can be provided for hospital patients or in the home. Many other varieties may be encountered during the nurse's career, and it must be agreed that fashion has a great influence on the bath of the moment. The complete science of bathing is called balneology, and it embraces many highly specialized types of bath which require special apparatus ; balneology is now a well recognized and important branch of physical medicine.

Mustard Bath.—The value of this bath in cases of chill or cold is well recognized ; especially is this so in the treatment of convulsions and other fits in children. The mustard bath may also be given for vomiting and diarrhoea. The temperature of the bath should be about 100° F., while the mustard, the allowance of which is 2 to 4 dessertspoonfuls to the gallon, is made up to a fine paste with tepid water and then stirred into the bath. For children, 5 to 7 minutes' immersion is sufficient ; adults may use the mixture as a foot bath over a longer period.

Emollient Bath.—Emollient baths are used to allay irritation and are sometimes consequently ordered in the treatment of diseases of the skin. Bran, linseed, oatmeal or starch may be used and it is expedient to enclose the substance in a muslin bag, allowing plenty of room for probable swelling before adding it to the bath.

Antiseptic Bath.—This is used to allay irritation in skin conditions also. Phenol, sulphur, iodine or creosote are some of the drugs used but others may be ordered to suit individual requirements.

Alkaline Bath.—This may be used for ordinary cleansing purposes and it is unwittingly used by many who add bath salts to their daily bath. Care must be taken that the carbonate of soda (washing soda) is not too strong, otherwise it may cause peeling of the skin. Usually 1 oz. of washing soda to every 4 gallons is ample ; it may have good effect in many rheumatic conditions. The water must be kept hot, as the patient must remain in for a considerable period to obtain the best effect.

Foot, Arm and Hip Baths.—The two former are used, generally with boric acid, to provide continuous lavage for burns,

accidental lacerations and septic wounds. All kinds of metal containers are provided (see Figs. 31 and 32). The bath should be arranged so that the patient has the maximum comfort and has no difficulty in keeping the limb securely in it. The lotion should be changed every hour. Hip baths (also known as sitz baths) are used when there is inflammation of the pelvic organs ; this form of treatment is very soothing in acute piles and in all painful menstrual conditions Water temperature of 105° F. is most satisfactory. While the patient is in the bath, a blanket should be draped round his

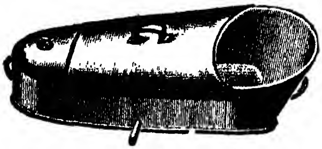


FIG. 31.—ARM BATH IN WHITE ENAMEL. (*By courtesy of the Surgical Manufacturing Co., Ltd., London.*)

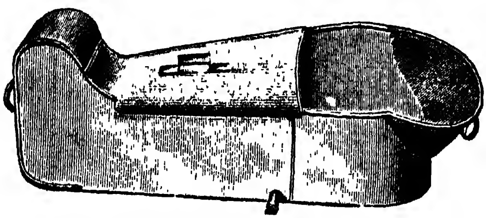


FIG. 32.—LEG BATH OF ENAMELLED METAL. (*By courtesy of the Surgical Manufacturing Co., Ltd., London.*)

shoulders and should hang down to the floor; another blanket should be packed round the feet. This ensures that the patient is warm and that the bath retains its heat as long as possible.

Sponging

In many cases it is advisable that the patient should not be taken out of bed, and therefore sponging either for cleansing or for medicinal purposes is resorted to. The blanket bath has already been referred to. Other methods of sponging are as follows.

Cold Sponging.—Sponging with cold or tepid water may be done when the temperature rises to a height of 105° F. or higher. By this method it is possible in some cases to reduce the temperature by 2°. There is no generally accepted method of cold sponging adopted as a routine, indeed various hospitals have different methods, but the aim is to lower the temperature as quickly as possible and with the least discomfort to the patient.

The following procedure may be accepted as a reasonable method, but it may be modified according to the circumstances

in which the nurse is placed. The undermentioned things should be collected : one long mackintosh sheet, 2 bathing blankets, water at 65° F. in a large basin, smaller basin to which ice is added, compresses for the head, hot water bottles for the feet and a sponge slightly bigger than a cricket ball. In certain cases it may be possible to provide half a dozen sponges, which can be used for the head, nape of neck, axillae and groins.

The waterproof sheet is laid on the bed and is covered by a bathing blanket. Then the patient is put on the blanket and covered with the second one. The personal garments are removed and a hot water bottle is put at the feet to promote circulation. During this time the temperature should be taken. After the thermometer has been checked, a cold compress should be placed on the head ; this avoids headache by preventing rush of blood to the brain. Some authorities recommend that the body be sponged quickly with hot water before the cold sponging begins. This is very soothing when the skin is dry and hot, as in fevers.

The principles governing the application of the cold water are 1. constant adjustment of the water, by adding ice, so that the temperature of the water remains at 65° F. or is allowed to become cooler when the patient can stand greater cold ; 2. regular supply of a film of cold water to the trunk and later to the limbs. Those who advocate the sweeping strokes with an almost dry but cold sponge do not appear to appreciate that the temperature is more quickly reduced when the water is really spread over by gentle circular stroking with a saturated sponge frequently replenished. The blanket below the patient becomes very wet, and in some cases to prevent pools of water from collecting in the room, the nurse may have to devise an artificial trough in the bed, made by rolling up blankets at each side of the patient and covering them over with mackintosh sheeting or towels.

If sponges be available, they should be transferred, dripping with cold water, to the regions mentioned above, and they should be replenished occasionally during the operation. It must be remembered that the body is hot and that therefore the thin film of water over it is quickly raised in temperature. To begin with the upper blanket may be turned down as far as the groins, and the sponging is carried out continuously for about 10 minutes, the nurse passing the sponge, which she squeezes lightly, all over the arms and the front and sides of the chest and abdomen. This may reduce the temperature, but if it does not do so, the lower limbs may have to be treated in the same way, with sponges in the groins and behind the knees. The patient may have to be turned over so that the back is treated, but it must be remembered that the minimum of movement must be allowed, and the patient

should on no account attempt to assist or to exert himself. In drying the patient, there should be no vigorous rubbing ; if the mackintosh and blanket are removed and a dry towel slipped below him, the surplus water will be absorbed and the rest of the body can be dried by patting the skin with a towel rolled up into a pad. The skin may then be powdered and the patient is covered with a blanket and sheet. The temperature is taken immediately; if it is down more than 4° F., the nurse must make arrangements to prevent collapse and may have to add a second blanket and hot water bottle. Febrile patients appreciate a cool drink after all this, especially milk. The temperature should be taken 20 minutes after the sponging is completed ; a record is kept of this.

When the whole body is exposed at one time, the procedure should take 10 minutes only, but when the trunk and limbs are treated separately, 20 minutes may be necessary. In carrying out this form of treatment the nurse must use her common sense, for every patient varies : in some the temperature is apparently reduced after a few minutes ; in others the whole of the work seems to be of little help. It is wiser to stop sponging too soon than too late. If the pulse becomes weak or the face cyanosed, it is time to put the patient between blankets. This method is often used in typhoid fever and it has very good effect in reducing the temperature at the critical time.

Tepid sponging, without many of the above formalities, is very often used in the course of ordinary nursing routine and it is very much appreciated by people who have perspired a good deal especially those with pulmonary tuberculosis or one of the various low types of fever, which leave the skin clammy and sticky.

Hot Sponging.—Sometimes when the rash of an infectious fever will not " come out," hot sponging with water at about 110° F. is done. The principle is the same as that of the hot bath, viz. the superficial blood vessels are fully dilated, the maximum volume of blood is spread over a wide cooling area and the temperature is lowered by the exposure.

Packs

A pack is literally a large fomentation applied hot or cold to the whole surface of the body for various conditions.

Cold Pack.—This may be made by applying to the patient's body a sheet wrung out in ice cold water, and sometimes with pieces of finely crushed ice enclosed. It is especially valuable in cases of heat stroke occurring in very hot weather.

The bed is prepared in the usual way by putting a mackintosh sheet covered with a bathing blanket below the patient, who is

stripped and supplied with a loin cloth. A plentiful supply of crushed ice and a tub of cold water should be available. There are several ways of applying the cold sheet ; 2 may be used, each folded into a square, thus forming 4-ply pads ; after being wrung out in ice water, they are applied, one below the buttocks, reaching as high as the axillae, and as far down as possible, and then folded closely to the body leaving the arms free, the other over the abdomen and chest and over the arms, to be tucked behind the neck and close to the spine all the way down the back. The patient is thus completely enfolded in a casing of cold linen or cotton.

A simpler way is to lay the patient on a double folded draw-sheet or bath towel wrung out in ice cold water, and then to cover him completely with a similarly treated sheet folded once in the long axis and applied lengthways. The feet may be left bare, but often shivering is so great that it is better to apply a hot water bottle to them. The forehead should also be covered with a cold compress. The sheets may be replaced every 5 minutes, but the treatment need not go on for longer than 20 minutes. It may be found more suitable to sprinkle the patient with iced water from a watering can or to apply ice to the upper sheet by rubbing a block backwards and forwards. When possible, the patient should lie covered by a blanket. After-treatment consists in gentle drying between blankets and then return to ordinary bed. The temperature should be taken 20 minutes after the treatment is completed. It is advisable to have brandy or sal volatile available, as collapse may occur. Cold packing is used occasionally in delirium tremens to induce sleep, but since the patient must not be disturbed, he is left, well wrapped up in blankets, in the pack for half an hour or longer, until he falls asleep soundly.

Ice Cradling.—Simple cradling, in which the lower part of the body is covered by a blanket and a cradle covered by a sheet is placed over the thighs and legs, is not so much used as ice cradling, the routine of which is as follows. The upper bed-clothes are removed ; the patient's feet and legs are wrapped in a single blanket, and over the body is set up a bridge of cradles (2 may be sufficient) extending from the chest to the toes. Cold compresses are applied to the head and a hot water bottle to the feet. Inside the cradle is hung a thermometer, as well as several icebags, ice pails or specially constructed ice trays. The patient is then enclosed in a well ventilated tent, made by draping a sheet over the cradles, with a space left for ventilation at each side or at the foot. The upper part of the sheet may be tucked round his chest. Except for the blanket round his feet, he should not have any clothes. The thermometer is carefully checked at intervals to ensure that the temperature of the cradle is

satisfactory and the temperature of the patient should be taken every half-hour. This treatment may go on for 3 or 4 hours, provided the patient is improving and not feeling uncomfortable. In some cases the addition of a water bed, filled with ice water, is very valuable especially when the patient is very weak e.g. in enteric fever.

Hot Wet Pack.—Owing to the powerful extraction of waste products induced, the hot wet pack is a common remedy in acute nephritis, in which the kidneys have ceased to do their work. The principle of the application of this great hot fomentation is the same as that of the cold pack, except that hot water is substituted for cold, blanket material for sheeting and that the patient is covered with a waterproof sheet. Generally speaking, the following are required : 2 mackintoshes ; supply of warm blankets ; 2 thin old blankets for the fomentation ; hot water bottles. A blanket is placed below the patient, who is naked, then a mackintosh sheet, then another blanket. Hot water bottles are applied to the feet and a cold compress to the head. The 2 fomentation blankets are then saturated with boiling water, wrung out quickly and then immediately applied below and above the patient as in the cold pack ; the waterproof sheet and under blanket are then folded over the fomentation blanket. The second mackintosh sheet covers the patient completely ; over it can be placed several blankets, tucked in below the under blanket. The patient is thus literally swathed in blankets, which retain the heat, while the moisture is prevented by the mackintosh sheet from evaporating and chilling the patient. During the treatment, hot drinks of various kinds should be given, lemonade or mineral water being best. Hot water bottles should constantly be supplied to maintain the heat of the application. The pulse rate must be checked regularly and stimulants should be at hand in case of collapse. Normally about three-quarters of an hour is sufficient for the treatment, after which the patient is put between hot, dry blankets for another hour. When returned to his normal position in bed, he should be well rubbed with hot towels and provided with a warm gown.

Hot Dry Pack.—This is a very simple method of causing profuse perspiration. The patient is rolled up in several hot blankets and a series of hot water bottles is arranged round his body. It is associated especially with the giving of the diaphoretic drugs, of which pilocarpin is the commonest example. Since this remedy acts very quickly, the dry pack should be very carefully prepared before the injection is made, and when the patient is under its influence the pulse must be watched carefully. Hot drinks are usually given about 15 minutes after the drug has

been administered so as to aid its action. The nurse should watch for signs of increased salivation.

Radiant Heat

Heat may be applied to the whole body, or to part of it, by means of several electric bulbs suspended from the framework of a cradle, and carefully covered by a blanket draped over the cradle. A certain amount of ventilation is necessary. Radiant heat is often used to treat shock, especially after serious operations. The cradle is placed over the legs and feet, and care is taken to see that the temperature is 100° to 105° F. The patient should be well enveloped in a blanket and may be left in the cradle until the temperature is normal.

Greater heat may be applied when increased excretion of waste products is desired. Ample ventilation must be provided for, and the temperature may be anything from 120° to 150° F. It is advisable to cover the patient with a sheet of light muslin in order to prevent reddening of the skin.

If one part only of the body is to be treated (e.g. in rheumatism, arthritis and other diseases) a special metal casing is used, forming a cabinet in which the part remains for a certain period which is increased as time goes on. Ultimately exposures of 20 minutes may be possible. After the limb is covered with a piece of blanket, the apparatus is fitted over it, and over the casing is draped a mackintosh and blanket to retain the heat. When the treatment is over, very great care must be taken to avoid chills ; indeed, it is usual to switch off the lamps at the end of the prescribed time and leave the limb for about 5 minutes so that perspiration may go on freely, as well as a certain amount of cooling. Brisk towelling is the rule afterwards. The temperature can be maintained at 115° F. or more.

Hot Air

Apart from the treatment of shock and collapse or for the local rheumatoid conditions mentioned above, hot air may be used for conditions in which copious perspiration is desired, combined with immediate evaporation of the sweat. In order to supply a regular amount of fresh hot air, Allen's stove is used (Fig. 33). This consists of a small dome-like cap with right-angled flue leading from its upper end, very much like the retort used in distillation industries. The heat of the stove is provided by a spirit lamp, which, as we already know from our study of the steam tent, must be completely protected against fire. It should therefore stand in a metal tray filled with sand, and a supply of sand should be handy in case of fire. The lower part of the dome

is cut to allow free entrance of the spirit lamp, while there are large perforations all round in order to permit the maximum ingress of air. The flue is intended to pass to the inside of a wicker or metal cradle and the utmost care must be taken that the free end is firmly suspended or supported, while it is customary to cover the flue with asbestos wool and sheeting, because blankets are draped over it. The pipe should not penetrate more than 3 inches inside the cradle. By the use of this lamp a temperature of from 140° to 175° F. can be produced.

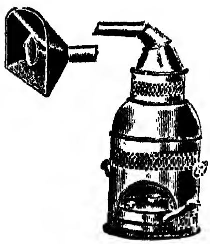


FIG. 33. — APPARATUS FOR PRODUCTION OF HOT AIR IN BEDS.
(By courtesy of the Surgical Manufacturing Co., Ltd., London.)

This method is very useful in kidney disease, as it ensures removal of the waste products and a general cleansing of the tissues, while the patient, unless he is left too long, does not experience the slightest discomfort and there is no interruption of his temperature mechanism. The usual articles should be collected as for other heating methods—blankets, mackintoshes, hot water bottles and so on. The preliminary applications of hot water bottles to the feet and cold compress to the head are made, then all the patient's clothes and coverings are removed except one blanket. Beneath the patient is put the usual " sandwich " of 2 blankets with a mackintosh between. He is then protected by wicker or light rustless metal cradles from head to foot, only the head from the chin upwards being left out. An " air marquee " is thus framed, and it is completed by draping over with blankets and mackintosh arranged as follows : first, one layer of blanket ; second, waterproof sheeting ; third, fourth and fifth or more, layers of blankets. After this has been done, the personal blanket over the patient can be withdrawn from the upper end of the tent. A secure flap is made by turning up the blankets on which the patient lies and tucking in the upper, or " roof," blankets below them. The upper blankets should be carefully tucked round the patient's neck and often a small blanket is folded and passed round the head like a shawl. The join of the flue to the cradle must be made at the lower end and the greatest care must be taken that there is no leakage through spaces left between the flue and the cradle by careless fitting of the blankets.

The temperature may be gradually increased while the patient is in the tent, and after it has reached about 140° F., it may be kept steady for 20 minutes by adjustment. No definite rule can be laid down for the heat, since everything depends upon the tolerance of the patient, and the treatment entirely concerns the particular disease, its type and degree. After the

prescribed period of maximum heat has been passed, the lamp may be removed ; the patient, covered once more by the single blanket, is allowed to remain for about another hour, or less, while the top coverings are slowly withdrawn. He is left to dry between hot blankets.

Hot dry air is essentially better for conditions of nephritis than is the electric bulb method; a constant supply of fresh, dry, heated air is the vital principle. In all these hot-air treatments, it should be remembered that we are dealing with something most fundamental in its action on the sensitive heat regulation centres. Unless the patient is constantly watched, therefore, the treatment may be allowed to proceed for a minute too long, and in that minute much harm may be done to the human machinery, resulting in collapse, breathlessness, quick pulse, flushing and suffocation. No matter how punctilious the discipline may appear to be, the nurse should never leave the patient, and should make a point of checking the temperature and taking the pulse every minute, making a note of the readings. She will thus be able to stop the treatment immediately the patient is in distress.

Vapour Baths

The taking of a Turkish bath is a common incident in the lives of those who are able to afford it and who want to get rid of surplus fat or waste products without effort, but the principle of the treatment is also applied in certain diseases. Vapour baths have the same effect as hot air baths.

In arranging for the vapour bath, exactly the same apparatus is required as for the hot-air bath (see above), but with the addition of a special kettle. In an emergency a bronchitis kettle may be used. The patient is prepared as described for the hot-air bath. He must be screened from draughts. As with the hot-air flue, the spout of the kettle must be just inside the cradle and no more. The condensed steam must be prevented from reaching the patient. This is done by fixing a can below the spout, or by a layer of cotton wool laid over the patient's legs. There is a special shield provided with Allen's apparatus. Whilst in the bath the patient may take mouthfuls of cold water or other fluid prescribed by the doctor. A strict watch must be kept as usual on the patient and on the thermometer inside the cage. Once the patient has begun to perspire the bath can be continued for about a quarter of an hour, but the temperature should rarely exceed 115° F. After the kettle is removed the patient must be covered with a hot blanket in the usual way. The cradles are then taken away and the patient, still actively perspiring, is left between hot blankets,

which at periods are replaced by fresh, hot, dry ones, until the skin has ceased to act and the patient is dry and comfortable. A quick tepid sponge down is then given, followed by thorough drying with hot towels, and a warm, dry, flannel gown is put on. If the patient prefers to sit up, an imitation Turkish cabinet can be made by using an ordinary chair with the spout passing below the seat. Blankets are draped all round, and completely envelop the patient to the chin; care is also taken that they are tightly fixed round the spout of the kettle.

CHAPTER 7

SURGICAL TECHNIQUE

SURGICAL CLEANLINESS. ANTISEPSIS. ASEPSIS. PREPARATION OF PATIENT FOR OPERATION. PREPARATION OF THE SKIN. PREPARING FOR THE THEATRE. POSTOPERATIVE CARE. POSTOPERATIVE SHOCK. TREATMENT. RECOVERY FROM THE ANAESTHETIC. TREATMENT DURING THE FIRST 12 HOURS. BLADDER EVACUATION. THE GENERAL CONDITION. AFTER 12 HOURS.

ALL operative measures, no matter how small they may be, must be carried out with strict observance of the rules of asepsis. This refers to the patient, to those performing the operation and their assistants, to the nurses in attendance, to the instruments and dressings and to the subsequent treatment of the affected area. All agree that the institution of absolute asepsis is very difficult in a world dominated by micro-organisms, but the more we exclude the germ from our patient the greater is his chance of uneventful and speedy recovery. The routine of asepsis in the ward has already been discussed (Vol. II, Section VI, Chapter 10), but we may now expand our knowledge to the whole subject of germ control in surgical technique.

Surgical Cleanliness

First of all, let us take stock of our present knowledge and of the agents at our disposal. We fully realize that germs are at the root of all septic conditions, that such states not only retard recovery but cause death in many cases and that in order to produce the ideal conditions for efficient healing, the work of the germ must be completely unavailing.

It should be realized that before Pasteur discovered microbes, and demonstrated conclusively that they were the cause of the terrible prevalence of suppuration in surgical wounds it was hardly worth while to do any but the most urgent and critical operations. Most of the patients who agreed to risk the operations were martyrs in the cause of science. The handicap to the surgeon was exceedingly great. The mortality rate was extraordinarily high.

New life was given to surgery when it became known that sepsis was the aftermath of a germ attack. The new science of bacteriology was initiated ; hundreds began to follow in Pasteur's footsteps and to attempt the elucidation of the complex problems of germ life and activity.

One of the more practical surgeons was Lord Lister. Faced with early disappointments and failures, he began to look round for something to counteract the evil influence of the microbic régime. A contemporary of Pasteur, he was the outstanding figure in surgery of the nineteenth century ; it is wonderful to think that these two men, working in different spheres, were able to revolutionize the art of healing.

Antisepsis.—Lister's method was to destroy the germ by creating an atmosphere which was saturated with substances known to be poisonous to it. Such substances we refer to nowadays as germicides or disinfectants. It is admitted that Lister was crude in his system, but it was a great advance in its time ; and from the early carbolic spray that permeated the operation room and diffused itself through the dressings and the clothing of the operators, and from the universal use of carbolic acid as an antiseptic lotion for flushing wounds and the dressings over them, there has developed our modern routine of asepsis.

Asepsis.—Nowadays we know that there is no need to saturate the air with disinfectant, but we realize that by contagion we may introduce many pyogenic organisms to an open surface. In practice, therefore, we eliminate as many bacteria as we can from the patient, his surroundings, the people actively engaged in the operation and the instruments and dressings involved in the treatment. Each aspect of the case has to be dealt with on its merits.

We have several disinfectant agents, and the idea is to employ the one most suitable to the situation. Thus boiling water or steam is the greatest germ killer we use; if bacteria and their spores are left long enough in steam or boiling water they cannot possibly survive, and the article exposed is said to be sterilized, sterile, or aseptic; in other words completely free of pyogenic micro-organisms. Steam or water is not always suitable, however. In certain cases, the fabric would be destroyed, and so we have to rely on the germicides. By a combination of these two methods, we can produce the state of surgical cleanliness or asepsis. Some substances do not kill the germ but maintain the latter in a harmless state so long as it is in contact with the particular agent. These are known as antiseptics. They prevent the organisms from multiplying. This is quite satisfactory for certain purposes.

Preparation of Patient for Operation

In accident and emergency cases the preparation of the patient may be limited by the urgency of the need for operation, but normally a patient who is to be operated upon for disease is subjected to a form of preparatory treatment which may last for from 1 to 2 days.

In ordinary circumstances the patient should arrive in the ward if possible 48 hours before the operation is to be performed. He should be greeted kindly and with every consideration. Particulars of his address and employment are taken and written consent obtained for the operation to be performed. His temperature and pulse rate are taken, and if he is unable to have an ordinary bath, a bed bath should be given. This is described in Vol. II, pp. 292–295.

The preoperative treatment aims at building up the patient's resistance and so countering shock, and aims also at preventing sepsis by adequate cleansing of the site of the operation. The diet should be nourishing and easily digestible and should contain little roughage. Extra fluid is valuable and glucose can be given to guard against acidosis. In the form of barley sugar this treatment is very popular with children. The bowels should be regulated by a dose—slightly larger than usual—of the aperient generally taken by the patient and therefore most suitable. Castor oil is rarely given now, as the purging produced causes unnecessary loss of fluid. Some surgeons order an enema saponis on the morning of operation, but usually only in cases in which the operation involves the lower bowel or other pelvic organs. The temperature should be taken and recorded twice a day ; any abnormality should be reported ; the nurse should note any cough or signs of local sepsis and report their presence to the doctor. Adequate rest is most important ; when sleepless or worried, the patient will require sedatives. Potassium bromide, grs. 30, or phenobarbitone, gr. 1, may be prescribed.

The urine should be tested on the morning after admission and again on the morning of operation ; this precautionary measure should never be omitted.

Preparation of the Skin.—On the evening before the operation the skin over the operation area should be carefully shaved. The patient should then have a bath or bed bath, particular attention being paid to the cleanliness of the site. The nurse then prepares a trolley and proceeds to render the skin as aseptic as possible. Having washed and dried her hands, she surrounds the area with sterile towels, then, using forceps, she dips a swab into spiritous soap and carefully cleanses the area ; then, warning the patient "it will be cold," she uses a swab dipped in methylated ether to remove all grease. Changing her forceps, she swabs the area, first with surgical spirit and then with the

coloured antiseptic solution favoured by the surgeon. When this coat is dry, she covers the area with a sterile towel, fixing it in position with a cotton bandage. A second application of coloured antiseptic and a fresh sterile towel may be applied the next morning. Accidental wounds or sores may require a small flavine dressing first, or saline may be used.

The antiseptic chosen varies according to the surgeon's beliefs; some still use liquor iodi mitis, others picric acid 2½ per cent, Bonney's blue or flavine. Colourless fluids such as "Cetavalon" or "Dettol" may be used so long as they are surrounded by an iodine frame.

Bone and Skin Operations.—For bone operations a longer preparation is required; 3 days are usually allowed. The coloured antiseptic is not applied until the 3rd day. Skin grafting also requires a 3-day preparation. Coloured antiseptics are not used; the last application is normal saline, not surgical spirit.

Preparing for the Theatre.—After as good a night's sleep as allowed by circumstances, the patient is given a light meal of tea and toast 4 hours before the time of operation. "Bovril," glucose or lemonade in small quantities may be given to within 2 hours. The patient is then dressed in a long flannel gown and woollen socks. All constrictions should be removed from neck and waist and jewellery should be put in a place of safety. A bald man will require a head shawl and in the case of female patients the hair should be covered by a linen cap when all hair grips have been removed. A mouth wash is then given and any false teeth removed.

The premedication ordered by the anaesthetist is given. Atropine $\frac{1}{100}$ grain (to dry up secretions and stimulate respiration) is often combined with morphine ¼ grain (to allay worry). The time at which the drug is given should be entered on the chart. A bedpan is then offered or a catheter passed, and the patient, with an empty bladder, is gently covered with warm blankets, lifted on to a stretcher and wheeled to the operating theatre. The nurse should accompany him, taking with her the chart, any x-rays, the operation slip showing premedication given and the amount of urine voided; a vomit bowl and tongue forceps should also be provided. As soon as the patient has left the bed, it should be prepared for his return, according to the instructions given in Vol. II, p. 305.

Postoperative Care

When the patient returns from the theatre, he is still under the influence of the anaesthetic. He may be suffering from shock, which is very common after severe operations. The nurse in

charge should, therefore, understand exactly what is meant by postoperative shock.

Postoperative Shock.—The shock following haemorrhage, severe injury and similar states has been referred to several times throughout this work. Primarily shock is a depression of the normal activities of the body, but one of the main effects is decrease of the amount of blood supplied at each beat of the heart; the capillaries are thus partially full only and all the cells suffer from lack of sustenance. The nurse must keep watch on pulse, respirations and temperature. The first is faint, sometimes imperceptible and rapid ; the second are increased slightly, very shallow and often irregular ; the third is subnormal. If the patient be conscious, the face appears to be shrunken and the eyes are deep in the sockets, the condition being accentuated by the intense pallor and cold clammy sweat. Any movement is deliberate and cumbersome. In certain cases, which may be very grave indeed, the mind is clear and collected.

Treatment.—Adequate preparation, a warm theatre and gentle transport to and from the theatre will all help to reduce the incidence of shock, which is increased by prolonged exposure, much handling of the tissues or excessive blood loss. On his return the patient should be received into a warm bed, the foot of which may be raised on blocks. A radiant-heat cradle or electric blanket may be used, but care should be taken not to produce sweating. If hot water bottles are used, they must be covered with thick flannel and placed outside the inner blanket, well away from the patient so that there is no chance of blistering or burning his skin.

The pulse should be estimated frequently and watch kept on the patient's colour and breathing. The head and shoulders should be turned to one side to maintain a good airway and the patient should not be left until he is conscious. Since return to consciousness is often heralded by vomiting, the bed should be protected by a suitable towel and the nurse should be ready with a sickness basin to assist her charge, taking care that vomitus is not inhaled. The semi-prone position is useful after operations on the nose or throat, as blood and other secretions run by gravity out of the mouth instead of collecting in the pharynx. Noisy breathing is a danger signal.

Fluid is essential ; a blood transfusion or intravenous saline drip may be commenced or fluid may be given rectally for the first few hours. When consciousness returns, sips of hot water or weak tea may be given.

Recovery from the Anaesthetic.—As a rule, the patient regains a partial semi-dazed type of consciousness, during which he may be sick, and he usually talks more or less coherently, but

in a few minutes he may relapse into a fairly deep sleep again and it is only after he recovers from this condition that he can be said to have recovered from the effects of the anaesthetic. A great deal depends upon the mental and physical make-up of the patient. The science of anaesthetics has made great strides during the last 20 years and nowadays the risks and the discomforts are at a minimum, so that many of the former difficulties do not now exist, nevertheless the "dregs" of any anaesthetic remain for about 12 hours after the patient comes out of the theatre if he has undergone a major operation, and his general condition cannot be satisfactorily assessed until the following day.

Treatment during the First 12 Hours.—Let us suppose that the patient has gradually come round and has had, without extraordinary incident, the usual sickness and restlessness associated with the postoperative condition. The nurse should first place the patient in the position most suitable to his condition. If there is any question of drainage of the peritoneum, the half-sitting position should be adopted, as described in Vol. II, p. 307. Patients who are old, or who suffer from chronic chest troubles, should be given a bedrest as soon as possible, as there is a risk of hypostatic pneumonia. This also applies to those who have had an operation on the stomach or the thorax.

Vomiting, which is much worse after ether than after chloroform, depends upon the contents of the stomach ; if the latter contains a small amount of food mixed with blood, mucus, saliva, ether and so on, there is bound to be difficulty, but once the stomach is empty, the patient may settle down to his second sleep and have no further trouble. After chloroform there is always the danger of the condition known as delayed chloroform poisoning, which results from ketosis (see Vol. II, p. 373). This is characterized by severe vomiting which goes on and on until the patient (often a child) becomes delirious, with small, rapid pulse, rise of temperature, great thirst and scanty urine ; the last on examination may be found to contain the tell-tale acetone. In such conditions, barley sugar, as described above, together with an appropriate amount of glucose and sodium bicarbonate given by mouth or rectum, is an urgent necessity.

Thirst is one of the first things complained of when the patient recovers, and the custom is to let him have half a pint of warm water if he can take it, as this frequently acts as an emetic and quickly washes out the stomach. This procedure is contra-indicated in gastrointestinal states. Sips of cold water may help ; the thirst is relieved as soon as the patient is able to retain the fluids. If not he may be given a rectal enema of warm water to which a small quantity of sodium bicarbonate has been added. Sips of brandy and water often are of sedative as well as of thirst-quenching property. In many cases, it is soothing

and of relief to the patient to have the mouth washed out with lime juice or lemon water. As a rule, however, he gradually develops the ability to keep down increasing quantities.

Bladder Evacuation.—One of the most important duties of the nurse is to find out whether or not urine has been passed. In abdominal operations especially, there is always difficulty in passing the first amount of urine, but if possible the nurse should try to encourage the patient as much as she can ; the application of heat is of assistance to many. But nurses of experience will testify to the fact that the less fuss made over the bladder action the better ; in 99 cases out of 100, if the nurse leaves the patient with the urinal and thus avoids standing over him like a martinet, she will find a specimen of urine ready for her when she returns. This specimen should be measured, tested and set aside for the surgeon's inspection. Should retention of urine persist for 8 hours an injection of an acetylcholine preparation, "Doryl" or carbachol, may be ordered, or as a last resort catheterization. Only in extreme cases, however, and then after permission by the doctor has been granted, should a catheter be passed.

The General Condition.—The patient is restless, capricious and usually very tired. The bedclothes are frequently out of order and pain begins to be a trouble. The good nurse will anticipate all these events ; she must be prepared to give constant attention, since the patient is not fully responsible for all he does or wants to do. Very often aspirin or sodium salicylate combined with sodium bicarbonate or "Veganin" will soothe the pain and discomfort, and only if the surgeon orders it should morphine be given ; the latter is frequently combined with atropine. Pain in the lower part of the abdomen may be due to collections of flatus, and if the patient is unable to pass flatus (a point about which the nurse should always make certain as she will undoubtedly be questioned by the doctor), he may be given a hypodermic injection of 1 c.cm. of pituitary extract, or a flatus enema.

After 12 Hours.—The problems which arise on the second day are 1. the food which should be given; 2. the evacuation of the bowels and 3. the general nursing of the case.

Food is governed by the nature of the operation and the condition of the patient. In the case of the patient who has had, say, a hernia operated upon, or other simple operation, light diet may be quite well tolerated and may be instituted on the first day. Fluids are generally allowed for those who have had serious operations, but every case is decided upon its merits. Too much milk is not good for the patient as it causes flatulence. The usual routine of gradually increasing meals as fully described later in this volume (see Section VIII) should be adopted, attention

being paid to the peculiarities of the patient. The dietetics of the postoperative state are a simple matter of commonsense application of established principles. If the bowel has been operated on, it may be necessary to stop all food by the mouth for 2 or 3 days, fluid being given intravenously as plasma or as 5 per cent dextrose solution, or by rectum in the form of normal saline or tap water.

The bowels should move on the 2nd day, an aperient having been given for their action ; in cases of difficulty, an enema may be administered. A mixture of magnesium sulphate and magnesium carbonate (mist. alb.) is effective as a rule, and there is no doubt that a new era dawns when the patient has had his first motion after the operation.

General nursing depends upon the local dressings, the special food or treatment and the routine in vogue. One of the main general principles, however, is complete mental and physical rest. The latter can be maintained by the various appliances available ; the former results from absence of worry and of irritating features such as unwanted visitors and the tackling of problems which should be set aside for the time being. A good nurse will see that her patient is free of all undue physical and mental strain. When the time comes for the patient to be allowed up he must be very gently dealt with, there being constantly in the mind of the nurse the fact that re-education and self-confidence demand great patience.

CHAPTER 8

THE OPERATING THEATRE

STAFFING AND RUNNING OF AN OPERATING THEATRE. THE THEATRE ITSELF. EQUIPMENT AND ITS CARE. PREPARATION OF OPERATING THEATRE. EQUIPMENT IN COMMON USE. DUTIES DURING AN OPERATION. NOTES ON MODERN STERILIZING EQUIPMENT. DRESSINGS STERILIZERS. PREPARATION FOR OPERATION IN A PRIVATE HOUSE.

THE modern operating theatre has been evolved from the mean, dismal and ill-lit rooms with sawdust floors, at one time the scene of surgical manoeuvres which today would be impossible. Asepsis has brought with it the demand for perfect hygienic conditions and as a result the construction of an up-to-date operating theatre demands the skill of the most brilliant architects in full possession of the principles of modern surgical treatment.

Any hospital of note takes a pride in the efficiency of its theatre. It is usually the centre round which revolves the whole of the surgical activities of the hospital ; it is the model upon which work of the lesser dressing rooms and other departments is based. In order to maintain efficiency, therefore, a very strict code is applied to all operating theatres ; probably nowhere else will a nurse find that a sense of discipline and of duty is so much required. Once she is fully theatre-trained, the nurse may consider that she has passed one of the most important milestones in her career. A full knowledge of every detail of the routine is therefore essential, and the following pages are devoted to a summary of the various duties connected with the running of a modern operating theatre.

Staffing and Running of an Operating Theatre

In an operating theatre there is a sister in charge and her staff usually consists of one senior nurse and one junior nurse, but she depends upon the surgical wards for assistance also. During an operation, one or two nurses may be " lent " to the theatre while the patient from their ward is on the table. The routine work, however, is all-important, and is supervised by the

sister, who is responsible for the records, reports, equipment, replacements, repairs, supervision of all associated surgeons' quarters, bathrooms, lavatories, anaesthetic room, sterilizing room and the daily round of work that goes on when operations are being done. After all the operation is merely the spectacular part of the theatre service. Before and after an operation there is much to be done in order to maintain the supply of appliances and dressings and to ensure that nothing will happen to cause hitch or delay in the surgeon's work.

The Theatre Itself.—Modern ideas of lighting, heating and ventilation are brought to bear prominently in the plans of the architect. Thus we find today that lamps are devised for the provision of shadowless lighting, that heat regulation is possible

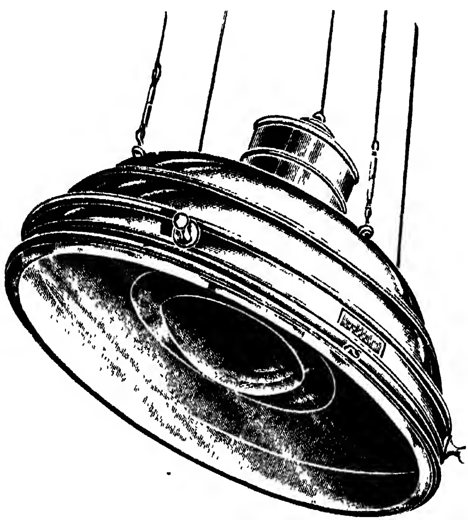


FIG. 34.—OPERATING THEATRE LAMP.
This does not cast any shadow
(By courtesy of the Surgical Manufacturing Co., Ltd., London.)

to a very fine degree and that fresh warm air is allowed to circulate according to the most suitable methods available The floors are paved with special material that is warm and soft to the feet yet resistant to cracks and water , the walls are tiled or thickly enamelled ; the corners are everywhere rounded to prevent accumulation of dust ; the fittings are stainless and rustless ; every improvement is added in order to prevent sepsis.

It is the duty of the theatre staff to see that the theatre is

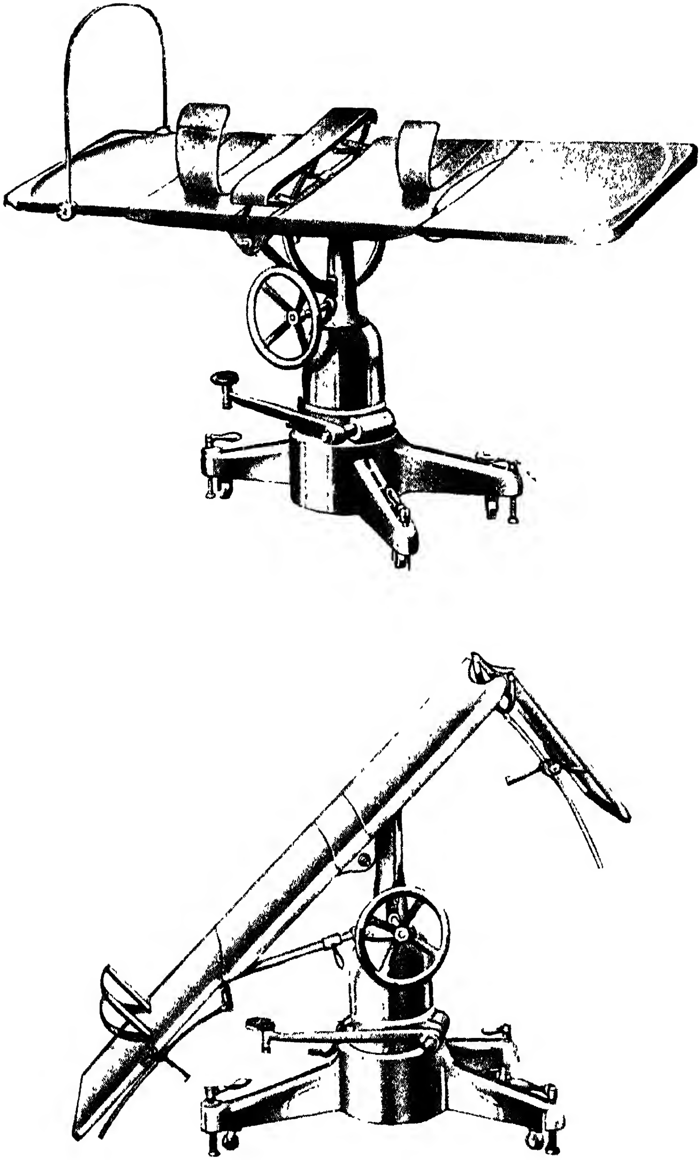


FIG. 35.—MODERN OPERATING TABLES.

maintained at its maximum efficiency. Thus the hygienic measures towards cleanliness must be complete. As we have noted elsewhere, dust must be counteracted at every turn. The idea underlying the construction of all modern theatres is that if necessary they can be cleansed by water forcibly ejected from a hose. This method, combined with mopping with damp dusters, should effectively remove all traces of dust which may have collected in an interval. The entering air is usually filtered and washed, but this does not prevent soot and other matter coming into the theatre, especially in centres in which there are factories and heavy industrial works. The temperature of the theatre is also of great importance. Normally about 65° F. is the average level, but some surgeons like it a few points higher, especially when a long abdominal operation is going on. Shock is lessened considerably by this method. A complaint often made about theatres is their humidity. It is admittedly very difficult to keep free of condensing steam and vapour when the theatre is at the temperature mentioned above and when assistants and spectators are present in numbers. In addition to this, the various sterilizers and other heat elements may add considerably to the moisture. An efficient and understanding nurse, however, aware of the possibilities of modern ventilation appliances, will ensure that the air is changed as often as necessary and will make arrangements accordingly. There will always be some excuse for a certain hot clamminess in any theatre owing to the nature of the work that goes on.

Equipment and its Care.—The main piece of furniture in the operating theatre is the operating table, which nowadays is a highly complex but easily managed machine, capable of many adjustments and equipped with all sorts of appliances to help both the surgeon and the patients. The table illustrated in Fig. 35 (*a* and *b*) is one of the most modern, but there is a wide range from which a choice can be made. The materials in use are iron, steel, brass, copper and nickel in various combinations and today chromium plate and stainless metals are very popular. Wormscrews and levers are provided so that the patient may be placed with his chest in a semi-inclined position, or with his head much lower than his pelvis (Trendelenburg position, Fig. 35 (*b*)); the table may be raised or lowered; the headpiece may be tilted to suit the anaesthetist. If necessary the table may be covered with an electrically heated blanket or by the older-fashioned method of hot water bed.

The rest of the equipment consists of anaesthetist's trolley and chair ; various types of apparatus for giving oxygen, carbonic acid gas, and special anaesthetics , tables for dressings, appliances, basins, instruments. Instrument cabinets may be kept in a side room or they may be part of the theatre furniture ; special

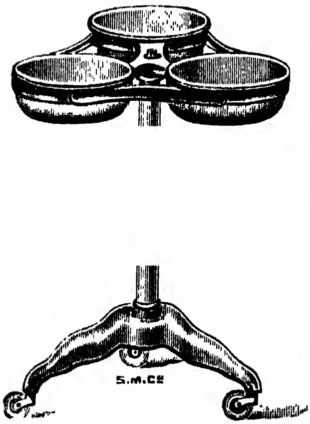


FIG. 36.—THREE-BOWL STAND ON RUBBER CASTORS.

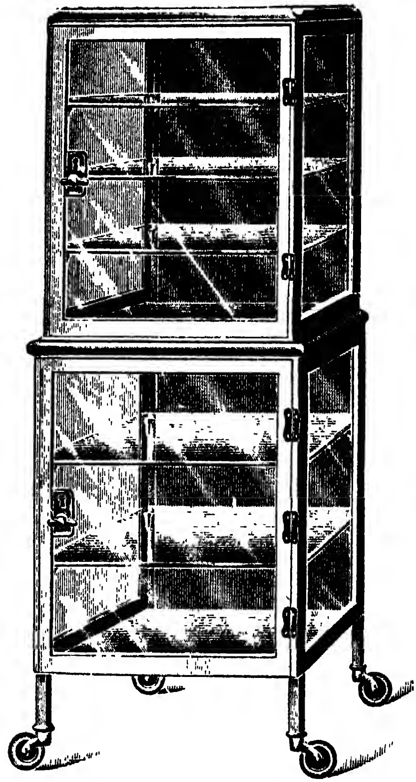


FIG. 37.—WHITE-ENAMELLED STEEL INSTRUMENT CABINET.

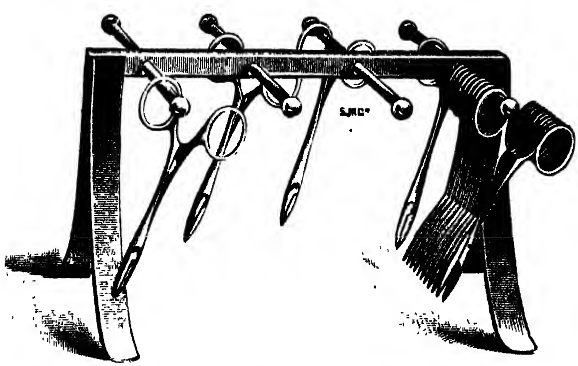


FIG. 38.—METAL STAND FOR ARTERY FORCEPS.

(By courtesy of the Surgical Manufacturing Co., Ltd., London.)

washing facilities are provided for the surgeons and assistants. Off the theatre there is usually a sterilizing room, a complete suite for the surgeon, containing bathroom and dressing room, an administrative room for the sister, with desk, chair, bureau for records and other storage places for dressings, clothing and other equipment.

Everyone in the vicinity of the patient should wear gowns and head coverings, carefully sterilized. In many cases, even the spectators are ordered to put on sterilized garments. The head especially should be covered by large triangular bandages so that the hair cannot stray into the scene at an inopportune moment. In many cases masks covering the face with the exception of the eyes are used, but in all circumstances gauze pads should be worn over the mouth. Most surgeons make a complete change, getting into approved operating kit, and the nurses may be required to do the same. Of great importance is the insulation of the feet ; if special "gumboots," carefully sterilized by phenol, are not provided, the feet may be encased in linen "socks," which, roughly shaped, are applied over the boots and trousers and tied below the knee. It may be added that rubber gloves are essential.

Preparation of Operating Theatre.—Several hours beforehand, the theatre staff begins to prepare for the operation. The furniture has been washed with disinfectant solution after the last operation and sterile sheets cover most of the equipment. Before taking these off, one of the nurses may mop the walls, floor and windows with a duster moistened with disinfectant, then the sheets are removed, and the tables, trolleys and similar furniture are once more dusted with a damp cloth soaked in disinfectant. The thermometer is consulted, the regulator is set and the ventilation apparatus is tested. The sterilizers are inspected and the preparation of hot water is begun. The theatre sister checks the electric suction apparatus, the diathermy machine and any other special apparatus that may be required. She selects the instruments, or supplies those provided by the surgeon, and arranges for their sterilization. Non-cutting instruments may be boiled for 20 minutes, sodium bicarbonate being added to the water, or they may be exposed to steam under pressure (20 lb.) in the autoclave. Cutting instruments should be immersed in pure lysol and rinsed in sterile saline solution before use. Drums are got ready, supplies of dressings are put in position, a check is made of the basins, bowls and buckets. The oxygen apparatus is inspected. The washing-up system is tested, care being taken to ensure that the levers act easily, that the water is boiling and that there is ample liquid soap, spirit and other lotions. The other preparations are made when the patient is taken into the anaesthetizing room.

Equipment in Common Use.—The dressings used in the theatre are in greater bulk and quantity than those in use elsewhere, but they are of the same type. Drums are sterilized in the autoclave belonging to the theatre, thus the surgeon is assured that the dressings he uses are aseptic (see Figs. 43 and 44). Each drum is carefully labelled according to its contents. One nurse is usually detailed specially to cut and prepare the dressings and to pack the drums, the contents of which are determined according to established plan.

Ligatures and sutures are the "threads" for binding wounds. The former are used for tying a vessel or for closing the stump left when a piece of tissue (e.g. the appendix) is removed. The latter are employed to unite two surfaces (e.g. the skin edges of a wound). They are used with needles in a way similar to that of ordinary sewing, but many special stitches are devised to make the union firm. Sutures may be made of digestible matter, i.e. they become dissolved by the tissue fluids after a certain time (examples, catgut and kangaroo tendon); as a rule, however, stouter material, such as horsehair, silk, linen, silk-worm gut, nylon and even fine silver wire or metal clips, are used, these all being unaffected by the tissues, and thus requiring to be removed after a certain time—the classical event of "taking out the stitches." Some of the above-mentioned equipment may now be considered.

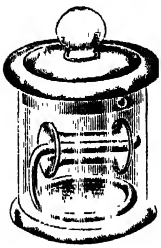


FIG. 39. — GLASS LIGATURE TANK.
(*By courtesy of the Surgical Manufacturing Co., Ltd London.*)

Catgut.—Much research has been done on this important substance, which is derived from the intestine of the sheep. Experts are still making tests, the difficulty being to obtain a perfectly sterile sample. Catgut cannot be boiled, therefore it must be prepared by soaking for a period of 8 days, or by other forms of treatment, in an antiseptic such as iodine and spirit or in chromic acid as described below. At one time, many hospitals were in the habit of preparing their own catgut, but modern manufacturers have reduced the preparation of this substance to a fine art, and now we can obtain very reliable catgut in sealed glass tubes which are broken only a few minutes before the surgeon requires their contents. The manufacture of catgut commercially is a very accurate process. The threads are made in 14 different calibres, the smallest of which is called oooooo and the largest 8. Each strand of catgut is care-

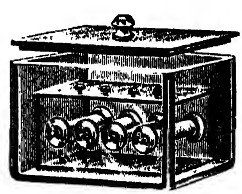


FIG. 40.—GLASS BOX FOR LIGATURES.
(*By courtesy of the Surgical Manufacturing Co., Ltd., London.*)

fully graded according to its calibre, then tested for strain on a special machine. It is then sealed up in a tube containing a special strength of iodine solution. Depending upon the calibre, the catgut is digested in from 7 to 21 days, but if it is desired to make the material more lasting, chromic acid is used. The crude catgut is first treated for 20 minutes in boiling ammonium sulphate, then under sterile conditions it is transferred to a bath of sterile water, then it is left for 24 hours in a solution of 1 in 10,000 chromic acid. Finally it is stored in iodine spirit. The sealed containers should be soaked in 5 per cent phenol for half an hour before use.

Kangaroo tendon is derived from the tail of the animal, and is also prepared specially, being sold in sealed tubes.

Horsehair, obtained from the tail, is generally used when we wish to put in the final skin sutures, therefore it is nearly always seen externally. Before use it should be soaked in ether to dissolve the fat, and then boiled for at least 5 minutes ; it does not stand repeated reboiling and may be stored in 5 per cent phenol.

Silk and linen are prepared in much the same way. The former material has 14 grades, and should be prepared, as near to the time of operation as possible, by boiling for half an hour in water without soda. It is then stored in a mixture of 5 per cent glycerine and 1 in 1,000 biniodide of mercury spirit solution. Reboiling tends to make silk fragile.

Silkworm Gut.—This is the gut used by anglers. It is the purest silk matter, and may be sterilized in exactly the same way as above. Only 3 grades are produced—fine, medium, and strong.

Nylon.—Coloured pale blue, nylon is useful for skin sutures and tension stitches, but it may also be used for repair of tendons or muscle. Before use it should be boiled for half an hour, and may be stored in biniodide of mercury, 1 in 1,000 solution.

Black Sewing Cotton.—This may be boiled immediately before use ; it should be stored dry. It is used for skin sutures.

Instruments.—It is impossible to enumerate completely the instruments required for an operation. First the type of operation governs the nature of the instruments ; a hernia requires a set of instruments entirely different from that required for cataract. Secondly, the individual surgeon must be studied ; as a rule he has certain likes and dislikes, but very often he has become used for several years to his favourite types and he may bring certain private equipment to the theatre. The nurse must make a point of knowing the predilections of each of her "chiefs" and of setting out the trays according to the man at work. The instruments described in Vol. II, Section VI, Chapter 10, are all more or less in regular use and additional examples are added according to necessity. Thus knives vary in size from

the huge amputation knife to the finest scalpel used for eye work. They include blunt-pointed bistouries, knives made so that the blades can be detached and fresh ones fitted at once (e.g. the Bard-Parker blade), hernia knives that are sharp only at a certain place, knives for dividing tendons in the operation of subcutaneous tenotomy, specially bladed knives, with shapes according to the nature of the tissues and knives which are used for general purposes. Forceps of all kinds must be stocked—dissecting, Spencer Wells, Kocher's, Halstead's, Moynihan's; scores of other artery forceps are available from which a selection must be made. There are special instruments such as hernia directors, ligature needles, retractors, clamps, trephines and sinus forceps. Curved needles, straight needles, scissors of all types (straight, angular, curved and curved on the flat), probes and needle holders must all be included. Indeed, it may be said that the armamentarium of the theatre is limitless. It is restricted only by the space available and the amount of money allocated. The nurse is recommended to make herself acquainted with the instruments of surgery by a first-hand knowledge of the equipment of the theatre of her own hospital ; then if she can arrange to borrow or procure an up-to-date surgical instrument manufacturer's catalogue, she will have ample scope to extend her knowledge.

FIG. 41.—BARD-PARKER RIB-BACK KNIFE.
(By courtesy of Chas F. Thackray, Ltd., Leeds.)

Other Appliances.—A supply of rubber tubing of various lengths and sizes should be kept ready as drainage tubes. They are always sterilized by boiling immediately before use. Little eyelets are cut on the sides in order to make the drainage more efficient. Usually the stock is kept in large jars in the theatre, a safe antiseptic solution being 5 per cent phenol in glycerine and alcohol, equal parts. Ribbon gauze should be kept handy, as it is often loosely packed inside the tube as a wick. Swabs have almost entirely replaced marine sponges, which are expensive, difficult to sterilize and a nuisance in the theatre when they become soiled. Various types are required. A small ball of cotton wool can be securely tied up in a small bag of sterile gauze ; this is useful for capillary oozing. Or small squares of gauze may be made by loosely fixing a hem all round. Larger sizes and thicknesses are required for abdominal operations ; these are known as pads ; they may be 6 to 8 layers thick

and 4 to 6 inches wide by 6 to 8 inches long, and are anchored to the wound by a tape (usually coloured) which is held in the blades of a pair of pressure forceps. Larger packs may be required for big abdominal operations ; these are used to keep the intestines out of the operator's way. The usual solutions must be kept ready, including normal saline and sterile water, both of which should be boiled just before the operation begins, then allowed to cool. As a rule arrangements are made for the provision of hot sterile water during an operation. The saline solution may be made of double strength, and when it is required the cold saline is added to boiling water measure for measure. The various basins, trays, kidney trays, bowls and so on are dealt with in exactly the same way as described previously. Towels, protective sheets and waterproof sheeting (cambric, jaconet) can be sterilized by steam. The heavier rubber sheeting may be scrubbed with soap, water and phenol solution.

Duties during an Operation.—It is impossible to lay down hard-and-fast rules for the duties of nurses while an operation is going on. Every sister has her own routine and the size of the staff varies considerably. Often in large hospitals the theatre sister acts as instrument supervisor, in which position, almost as important as the assistant to the surgeon, she anticipates every move and has the appropriate instrument ready for the surgeon as he may require it. In this way she is the supply officer of the equipment of the theatre. In order to maintain her stock and to make good any casualties, she must have two lieutenants, these being represented by the two permanent nurses attached to her staff. A detailed description of the duties of each nurse during the operation is deemed unnecessary ; staffs which vary so much in size cannot have a fixed routine. But the fundamentals of the work must be understood and they are briefly enumerated below.

Assuming that with a full staff the sister is fully occupied at the table ; the senior nurse is aseptic nurse, the junior nurse will act as so-called septic nurse. For all practical purposes, the junior nurse is the " hewer of wood and the drawer of water," while the senior nurse keeps herself free from septic influences and is the go-between linking up the basic supply with the local supply at the operating table. On these general lines all operating theatres work smoothly. On no account should the work of the septic nurse encroach on that of the aseptic nurse, and vice versa. It is a safe and very sound maxim, however, that the whole theatre staff should aim at complete sterilization during the operation.

When the operation begins, the aseptic nurse, if she is assistant to the sister, stands by the patient after he is brought in. The septic nurse usually does all the preliminary work of assisting

with the patient, of taking off unnecessary garments, of arranging blankets, of removing the outside bandage and the cotton wool of the preliminary dressing and of supplying lotions when asked to do so. All these duties may be performed by a nurse sent with the patient from the ward, however. Meanwhile the aseptic nurse delivers the instruments to the sister, including towels, sees that all that is required is in position and has ready the iodine when it is in use in a sterile glass ready for the first painting of the area. The sister may spread the sterile towels round the wound. It must be remembered that the two jobs may be merged, in which case the aseptic nurse's work is entirely carried out by the sister, but it is rather exacting and often causes hitches. Nurses must be prepared, however, to carry out the full duties single-handed in hospitals in which the staff is limited.

Meanwhile the septic nurse is looking after the sterilizers, is constantly ready to bring hot water, saline and other solutions when required, and sees that soiled solutions are emptied and replaced. If instruments are dropped on the floor or handed back to her from the table, she immediately arranges for their sterilization and the aseptic nurse takes them back as soon as they are ready. She must be ready to act on any sudden order. The aseptic nurse sees that the sister has assistance when necessary ; this may be indicated in a big operation involving the handling of many instruments and swabs. It is sometimes impossible for one nurse to control the whole of the local supply, and the second aseptic nurse may be detailed to deliver and keep count of the swabs only, while the sister concentrates on the instruments, needles and ligatures. Most nurses will find, however, that such a policy of perfection is rarely possible ; with only one aseptic nurse available, she will have to devise some method of controlling her multifarious duties, but in cases like this there is generally a second septic nurse available, so that the work is evenly distributed on the whole. Success in all operative work is obtained by the full realization of the principles of strict asepsis at the operating table, and of the definite place at which the septic nurse's work begins and the aseptic nurse's work ends, and vice versa.

At the end of the operation the sister usually takes stock of her instruments and makes a note of the replacements required, while the aseptic nurse stands by to supply the final dressings. She must report the number of the swabs recovered. These are often placed on the floor in a special place. If handled, they must be enumerated only by the septic nurse, who counts them in the presence of her senior. The septic nurse must also help the patient off the table or out of the theatre ; generally he is taken over by a nurse from the ward. Once the patient is out

of the theatre, the septic nurse must rapidly clean up for the next operation, taking away buckets, wiping the floor with a mop and generally removing all traces of the operation just finished.

When the day's operating is finished, the whole staff usually converts itself into a " septic " squad, care being taken first that all sterile material is carefully removed. The usual counting, washing and polishing of instruments is gone through, equipment is generally replenished and after the theatre has been restored to its non-active orderliness, the staff may go about the routine duties of preparation of dressings, filling of drums, soaking of ligatures and other work of the theatre.

The above is a mere example of a theatre team in action. No doubt all nurses will understand that it may not be possible in many instances, and that it may not have been described exactly as they themselves have experienced. The only way to obtain a sound knowledge of theatre work is to go through the course of training and to spend periods in various theatres. It will then be apparent to the nurse that there are scores of different systems for running an operating theatre, each one based on the conditions influencing the situation and devised to make the best of the case in the circumstances.

Notes on Modern Sterilizing Equipment

By J. C. Robinson

It is necessary that nurses should be acquainted with the general features of modern sterilizing installations. Those who were trained in the earlier days would, when confronted by a modern set, naturally imagine that their training had been somewhat inadequate for the proper understanding and efficient manipulation of newer and apparently complicated mechanism. There is, however, no occasion to underrate one's capabilities although the first impression may be somewhat confused. The fundamental principles applying to elementary apparatus remain as a constant factor. It will be observed from the examples we have illustrated that the installations are classified either as the open type or as the enclosed type. The open type represents apparatus constructed on the first principle, with which we are familiar. There are variants in design, construction and character and according to different makers' standards, but in its essential unity it is the result of an evolution of our old friend the fish kettle. Apparatus of this open type may be of a very high order in design and craftsmanship, and although certain authorities express a decided preference for the enclosed type, in certain circumstances the use of the open type continues to be the right practice.

The suite shown in Fig. 42 is one of several which are installed in a large London hospital. The hospital authorities gave careful consideration to the practicability of American and Continental models before determining the type of equipment most suited to their needs Illustrated are a pair of hot and cold water sterilizers, bowl and instrument sterilizers, and a hot cupboard, all heated by steam jackets—a method which leaves the interior bottom surfaces clear, and preferable to coil heating with its objectionable scale deposit. The bowl and instrument sterilizers have hot water connected directly to them. The water sterilizers have cold water charged to them from the main supply, and to prevent the seepage of water through a leaky tap they are both indirectly charged through one swing arm tap.

An important manipulation in the preparation of sterile water is the sterilization of the water in the gauge glass, which by reason of its distance from the heat source is not rendered sterile, even when the chamber water is boiling at 220° F. There may be 2 valves attached to the fitting or only one with a dual action, operating the same as 2. The process is as follows. While the water is boiling, and steam generated in the space above it, the valve to the chamber should be shut and the other—the drain valve—opened in order to discharge the water from the gauge

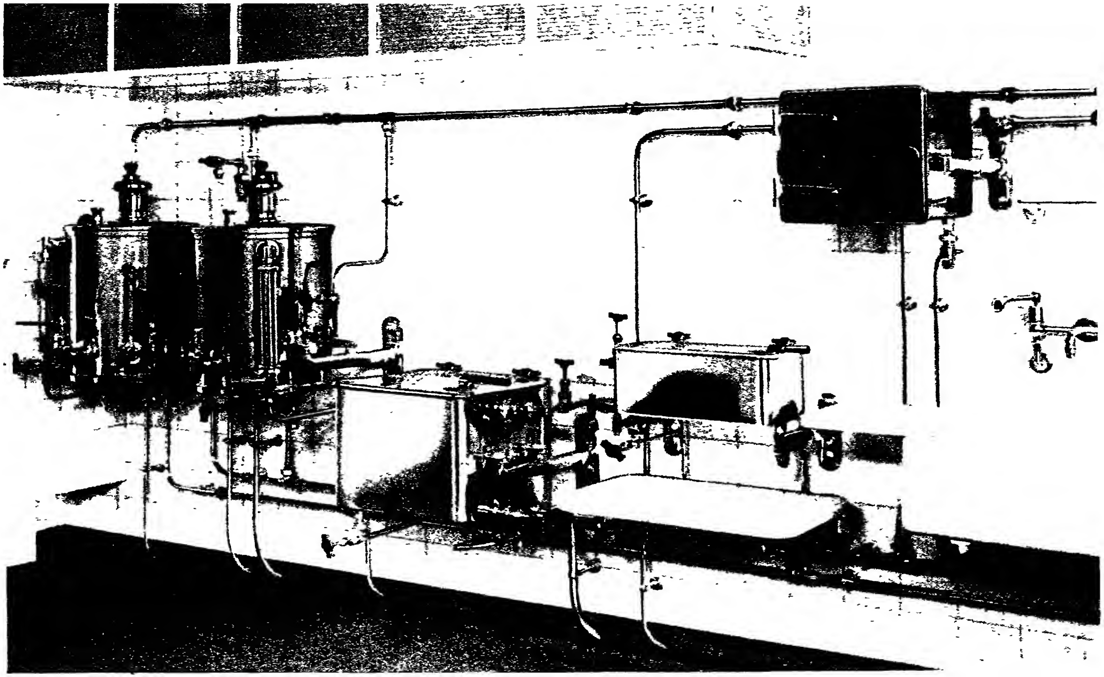
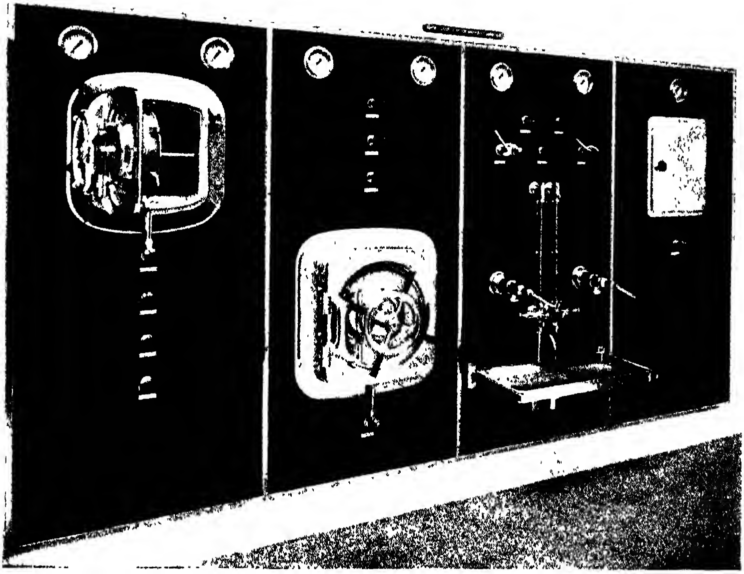
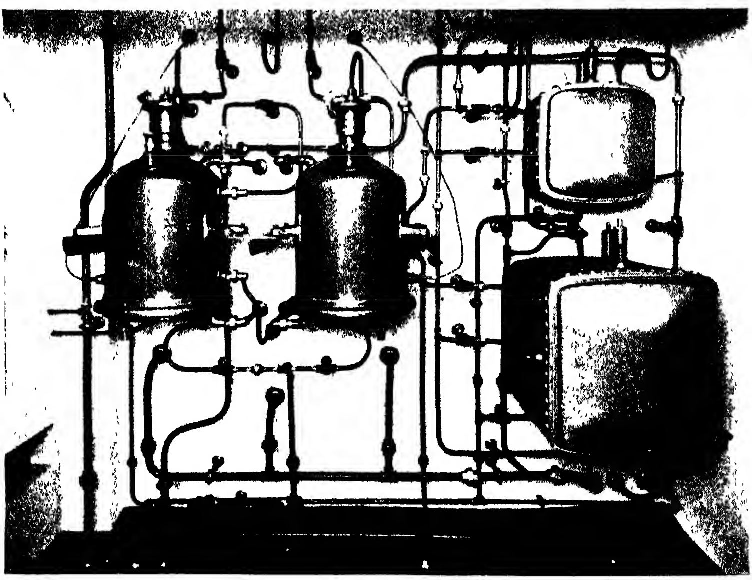


Fig. 42.—Exposed or open Type of Sterilizer for Hot and Cold Water, Bowls or Instruments.

(By courtesy of Messrs James Slater & Co Ltd, London



(*a*)—The Front Panels.



(*b*)—Inside View.

Fig. 43.—Enclosed or Built-in Sterilizer.

(*By courtesy of Messrs. James Slater & Co., Ltd., London.*)

glass. When it is emptied, steam will follow through it. Continue this flow of steam for the space of one minute, when the interior surface of the tube will be sterilized. Then close the drain valve, and open the other—the chamber valve—when the sterile water from the chamber will flow and will rise in the glass. Thus it follows that sterile water is now contained in a sterilized glass tube.

Where a single valve with a dual action is applied to the fitting, the action of opening to drain automatically shuts off the chamber flow, and conversely, closing the drain admits the chamber flow. The maintenance of a temperature of 220° F. for 10 minutes renders the water sterile. The cold sterilizer is cooled by cold water flowing through an internal jacket.

Fig. 43 shows a typical example of a sterilizer constructed on the enclosed or built-in principle, which has been applied to some of the later installations in Great Britain. There are two pressure steam autoclaves. Instruments and gloves are treated in the smaller and bowls in the larger. Sterilization is effected by steam at 6 lb. pressure. In conjunction with this set an open-type instrument sterilizer is fixed to an adjacent wall. For the sterile water service (hot and cold) the draw-offs, gauges and controls only are projected from the panel. The apparatus and service piping are contained in a chamber immediately behind the panel. The external appearance is attractive and the absence of pipework creates a very favourable first impression. But we must remember that there is a reverse side, and this external simplicity really involves a greater complexity in the sterilizing chamber than obtains with an open set.

The above system can be free from criticism only when the circumstances are favourable, and when design does not interfere with accepted hygienic principles. The view from the chamber side (Fig. 43 (*b*)) illustrates the intricacies of the system, and although it is a well thought out arrangement under favourable conditions, it is obvious that the system is not applicable when there is not easy accessibility for cleaning the apparatus compartment.

Dressings Sterilizers.—An example of the rectangular type of dressings sterilizer, which has recently been installed in various hospitals, is shown in Fig. 44. Since the cases which hold the dressings are of rectangular shape, they fit more economically into the space of the sterilizer and they are thus an improvement on the old circular pattern.

An accepted formula applies generally in the treatment of dressings. Three phases may be defined, viz. 1. the 20-inch vacuum ; 2. 20 lb. of steam for 20 minutes ; 3. 20-inch vacuum for drying.

This is an empirical rule with a sufficient overproof margin to

admit of slight variations in actual practice according to the density of the goods to be treated. Gowns and towels should not be closely compressed, as the residual moisture of dry saturated steam cannot be eliminated in a convenient drying time. The working instructions provided by the makers of these machines should be adhered to. A pressure and time recording instrument is usually applied, thus giving a chart diagram of the actual processes to which the dressings have been submitted, and which is filed as a true record. Because of a contingent factor, however, this true record cannot in itself be admitted as final proof. Investigations carried out over an extended period in Great Britain by the writer revealed that air filters were frequently found to be in an impure condition. In the final indrawing of air for drying the dressings after the steaming process, the cotton wool filtering medium, contained in a filter cup, was very often dirty (in some cases quite black) from having been unchanged for years, thus resolving the filter into an ideal incubator for propagating bacteria, which, being drawn into the chamber, would reinfect the dressings that had been sterilized. As proof of this an instance may be cited. A serious outbreak of mastitis occurred at a maternity hospital and persisted over a considerable period. The real cause baffled many recognized authorities until finally the outbreak was traced to a foul air filter. Owing to ignorance of its purpose, the person responsible had not changed the cotton wool since the sterilizer was first installed. By the substitution of a more effective filter the trouble cleared up and has not recurred. Many operations that have not been successful have been traced to this source of infection and the need for the greatest care in renewing the cotton wool in external air filters cannot be too strongly emphasized.

Air filters are of two types—the old external, and the later internal ; the latter is a distinct advance on the former and is comprised in most modern plants. It is disposed within the chamber and the cotton wool is automatically sterilized with each successive steam processing. It is to be observed, however, that this internal type of air filter is not entirely foolproof. As with the external, the cotton wool should be renewed once a week as a rule, not on account of fouling, but because the wool tends to become charred by the high temperature steam heat.

The illustration of the glove sterilizer (Fig. 45) shows an autoclave apparatus for the special treatment of gloves at the low steam pressure of 3 lb. Experiments showed that for surface sterilizing this pressure was adequate and as a result of this careful treatment the life of gloves was materially extended. If gloves are treated with steam at high pressure, their deterioration is very rapid ; they survive usually 2 or 3 exposures, while with the low pressure method their life is extended to 8 or 12,

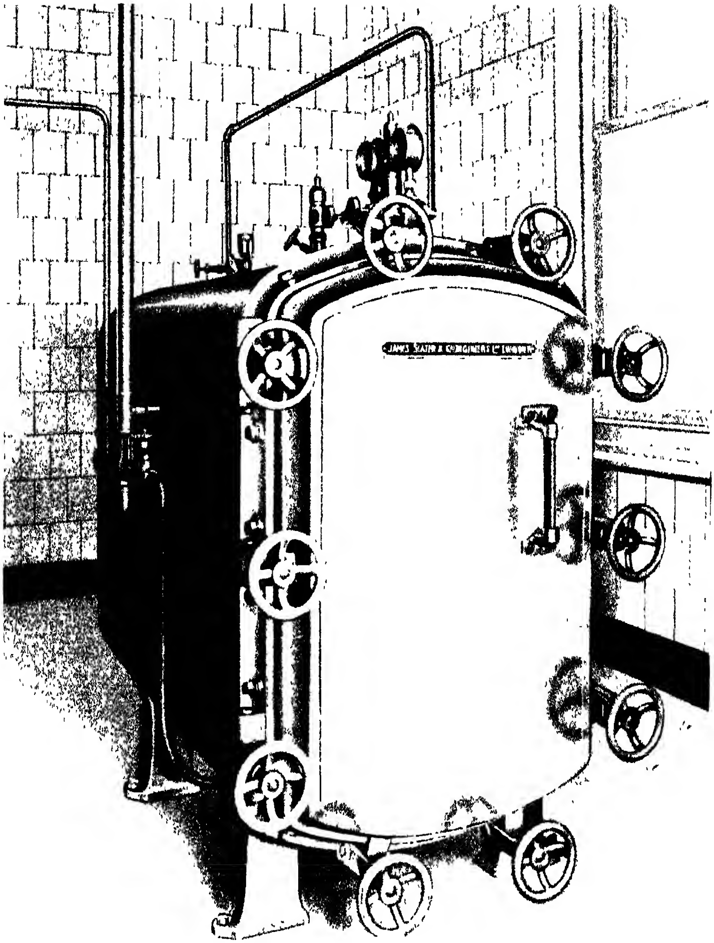


FIG. 44.—DRESSINGS STERILIZER. RECTANGULAR TYPE.
(*By courtesy of Messrs. James Slater & Co. Ltd. London.*)

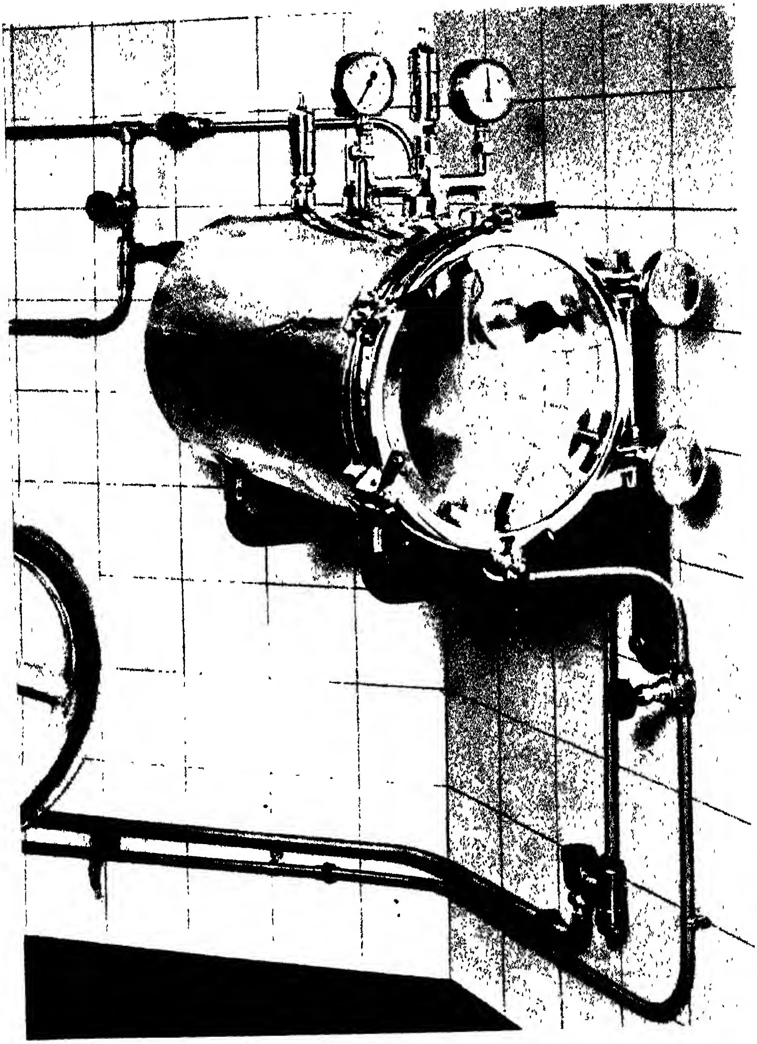


FIG. 45.—SPECIAL TYPE OF STERILIZER FOR GLOVES.
(By courtesy of Messrs. James Slater & Co., Ltd., London.)

which is a considerable economy in the gloves account. The foregoing was the basis of procedure from the year 1928 to the year 1938 which on tests then made was regarded as satisfactory. Since that period, however, there has been a more intensive investigation into the effective sterilization of gloves, and findings have differed. The Ministry of Health state that a pressure of 5 lb. is effective. Professor Canti raised the pressure to 6 lb. and recommended the application of a 6-inch vacuum, both to effect the initial clearance of atmospheric air and to accelerate the final drying, by exhausting the last vestiges of vaporization. In this proviso it is to be observed that he was treating gloves in considerable bulk. However, the 6-inch vacuum with 6 lb. pressure became an accepted standard for both large and small sterilizers.

Then came the war period, with gloves of inferior quality; the glove makers recommended treatment at the higher pressure of 10 lb. and existing apparatus was modified to conform therewith.

After the war, gloves improved and it became a moot question whether the 10 lb. pressure should be retained or reduced to the 6 lb. again. Further scientific investigation revealed that the cotton bags enclosing the gloves required 10 lb. pressure to render them effectively sterile and as they could not be contained in an unsterile envelope, both had to be submitted to the same 10 lb. steam pressure, which has now become the accepted standard. A 6-inch vacuum is considered adequate for the initial air exhaust and for the final drying off. It is to be remarked that the initial exhaust at 6 inches does not remove the air content entirely. On introducing steam after exhausting, and when zero pressure is recorded, the drain valve should be opened, to expel the residual air. When steam issues freely from that vent, the drain valve should be shut off to build up to 10 lb. then left slightly open to clear the water of condensation throughout the steaming process, then shut under vacuum. Talcum powder should be certified by the makers as sterile. If not certified, it should be treated in a hot air oven at 400° F., for 20 minutes per lb. bulk, the tray spread with a layer ½ inch thick.

In the apparatus illustrated steam is the prime heating agent, and it is beyond all question the most effective and economical medium. Where steam is not available gas and electricity are alternatives. With the former there are risks and both the L.C.C. and the Metropolitan Fire Brigade suggest that it should not be used in operating theatres and adjoining rooms.

The right practice with gas is to apply it as the prime agent to a steam generator at a safe distance from the theatre and to run a steam service therefrom to the sterilizers in the same way as from a central steam plant.

Electrical installations are not much higher in first price, but the running costs are considerably in excess of those of gas or steam. The heating elements are of high efficiency but their life is determined if they are run dry. Great care must be observed in keeping a water content above their level, as although elements can be readily replaced a breakdown during an operation would be a very serious matter indeed. Automatic devices are not to be regarded as absolute safeguards, as their function is variable. Even although they are fitted this fact should not reduce the vigilance of those concerned with their working. Personal responsibility should not be given up in favour of this mechanism, which is designed to adjust a possible human error, but the intelligent brain of the nurse in charge is always to be preferred to any mechanical gauge, no matter how perfect the latter may be.

Preparation for Operation in a Private House

Nursing homes and hospitals are so perfectly equipped and so easily and comfortably reached nowadays that there is very little operating done in private houses. A nurse, however, isolated in a country district, or suddenly faced with an emergency, may have to convert a dining-room or a bedroom into a theatre.

A good light and plenty of space are two things to aim at. The nearer the patient's bedroom the better. The room may actually be the patient's bedroom. As most of these operations are emergency ones, there is no need to raise dust by having a "spring cleaning." After wiping the furniture with a duster soaked in antiseptic lotion, and stowing as much of it as possible in corners, the nurse should spread sheets moistened with phenol solution over it, a similar covering being placed over the carpet. If there is time, however, a rapid clearance of almost everything should be made, especially if 2 or 3 days' notice is given. In this case real effort should be made to make the room resemble a proper operating theatre. Linoleum may be left on the floor, but carpets should be taken up, curtains removed, pictures taken out and only useful furniture such as the table and sideboard left. These may be used to accommodate bowls, drums and other equipment. A charwoman should be told to scrub the floor and the paint thoroughly, and to mop the walls with a disinfectant solution. The floor may or may not be covered with a disinfectant sheet, but it is advisable to lay a large square of mackintosh under the operating table.

In some cases, it is necessary to import a washstand and kitchen table to be used as "trolleys," and if the surgeon does not bring his own portable operating table, one may be hired ;

but many a good job has been done on a plain deal kitchen table, which should not be despised by any means. Kitchen chairs, carefully disinfected, may act as tables for instruments and dressings at the operating table ; they should be covered with mackintoshes and sterile towels. Two buckets should be provided.

With regard to vessels and containers, the nurse must raid the kitchen and select the things that will suit best. Copper pans, jelly pans, aluminium saucepans, fish kettles and various baking basins may all be impressed into service. An enamel pie dish makes a very good instrument tray, while a large fish kettle is ideal for sterilizing instruments. Most of these containers should be sterilized in the operating room by pouring in a little methylated spirit and setting it alight. The usual lotions and solutions must be ordered by the nurse, and overalls and other costumes are easily obtained, so there is no need to improvise. The hot water supply in the kitchen may be maintained by a cool-headed relative who should be shown how to fill enamel jugs with boiling water, then how to cover them with sterile squares of linen or towelling until the water is required, either hot or cold. In almost every case the surgeon brings drums containing an ample supply of dressings in addition to his own instruments.

CHAPTER 9

LAST OFFICES

SIGNS OF DEATH. LAYING OUT THE BODY. AFTER-TREATMENT OF THE ROOM.

DEATH may be sudden, in which case the premonitory signs may not be demonstrated, but in the majority of cases death gives its warnings for at least a day before life becomes extinct. In both cases the nurse should be very conservative and restrained about announcing the fact to relatives. It is always better, if there should be the slightest doubt, to wait until a professional opinion has been passed. Especially is this matter important when a patient is unconscious for some days, and gradually "sleeps away," as the expression goes. It is most disconcerting to relatives, however lingering the patient may have been, to be told that the looked-for death has occurred, and then to find that there is still a flicker of life. No matter how advanced a disease may be, lay persons always cling to hope of recovery, therefore nurses who value their reputation will refrain from all final announcements until death is certain or until the doctor has confirmed the suspicions. In many cases, the medical man who is expecting death does not consider it necessary to call at once and see the patient, but usually he makes a point of paying a courtesy call as soon as possible. Nurses must therefore know the signs of death.

Signs of Death.—
The breathing stops.
The pulse ceases.
The jaw drops.
The eyelids are half closed.
The pupils are dilated.
The skin is cold and clammy.
Stiffness (rigor mortis) sets in.

The old-fashioned method of putting a mirror to the mouth and proving that there is no moisture on it is still in use in private practice as a decisive sign of death. It must be remembered, however, that all people do not die in bed, and there are

specific cases in which even cessation of breathing does not mean death. For example, drowning accidents may produce apparent lifelessness, but it is well known that artificial respiration must be continued for hours after the victim is found, and many cases of miraculous recovery have been reported as a result of this treatment.

Laying out the Body.—Immediately after death, it is advisable to let all professional considerations take second place, and to allow the relatives a few minutes in reverent silence at the bedside. A few apt words from the nurse never go amiss and this is one of the occasions on which the personality of the nurse should be fully expressed.

After the relatives have gone the nurse should communicate with the doctor and obtain permission to lay out the body. A note should be made of the exact hour of death.

The dressing of the body is more important than the daily toilet of the living patient. Two persons should do the work and they should carry it out expeditiously, with all reverence and in silence. The eyelids should be closed with small pledgets of wet cotton wool ; the lower jaw should be fixed to the head by passing a 4-tail bandage or 2 turns of a domette round the lower jaw and over the vertex ; the ankles should be tied together ; the whole body should be straightened out. All this is necessary in view of the early occurrence of rigor mortis.

Before the toilet of the body is begun, all rings, jewellery, ornaments and personal belongings of the patient should be collected, an inventory made and the whole passed into the hands of the steward, who will deal with the relatives ; this relieves the nurse of all responsibility. In private practice the responsible relative should be given the articles, preferably in the presence of a witness.

All the upper bedclothes, with the exception of the sheet, are removed and laid aside for transfer to the disinfecting department. The whole body is washed with soap and water. The nails are trimmed and the hair is combed and brushed. Any wounds are treated with new dressings. The anus and vagina are packed with splint wool or tow. A special white nightgown is put on the corpse. Stockings may be added, in which case the binding is made on the outside of them at the ankles and knees. The bandage round the jaw can be removed once rigor mortis is complete, and the cotton wool may be taken from the eyelids, which are closed. A clean bottom sheet is put on the bed and one pillow is provided for the head. The body is covered completely, including the head, by a fresh top sheet. Occasionally a folded towel is placed underneath the shoulders, the hips and the knees, so that removal by the undertakers will be facilitated. It is advisable either to cross the hands in front

of the chest or to allow the arms to lie straight and very close to the side. Mortuary sheets of special size are usually provided in large hospitals, and in these the corpse is rolled, with the name, age, ward and time of death written clearly on a piece of paper fixed securely to the sheet. If the patient is a Jew, he should not be handled by a Christian nurse unless the relatives are first consulted. Special arrangements are usually made in these cases.

After-treatment of the Room.—In a hospital, the cleansing of the bed can be proceeded with immediately the patient is removed to the mortuary, but in a private house often the nurse is asked to remain till the funeral is over, and thus is able to dismantle the room. The latter should have a thorough " spring cleaning," all carpets, curtains and furniture being disinfected. The bed should be stripped and carefully sterilized. The mattresses and bedclothing should be sent away to be steam disinfected. The room should be left to air for a day or two. The relatives usually undertake the reorganization of the room, which, after a death, is often painted and completely altered in character and appearance.

SECTION VIII

PHARMACOLOGY, THERAPEUTICS AND DIETETICS

CHAPTER 1

DRUGS AND THEIR ACTIONS

Introduction

Definitions.—Pharmacology is the science dealing with the actions of drugs, therapeutics with the treatment of disease including the use of drugs and chemotherapy with the use of drugs in infective diseases.

The Nature of Drugs.—Drugs may be derived from biological sources such as plants (digitalis) or animals (insulin), or they may be purely chemical in origin and either refined natural products (magnesium sulphate) or complicated synthetic chemical compounds (arsphenamine).

Action.—They may act by stimulating, depressing or irritating living cells. While their actions are often concentrated on one particular type of cell, they are rarely confined to this one type, and they are usually accompanied by undesirable side reactions.

Administration.—Drugs may be applied *externally* for a purely local effect or for systemic absorption. They may be administered *internally* by mouth, or injected by the intradermal, subcutaneous, intramuscular or intravenous routes. Absorption by the parenteral route may be delayed by injecting the drug in oil or administering it in a relatively insoluble form, as in the case of procaine penicillin. Administration by the oral route is to be preferred, but this is impossible with drugs which are destroyed in the intestinal tract.

Excretion.—Drugs or their metabolic products may be excreted in the urine, saliva, sweat and milk and as volatile substances by the lungs. Drugs are often destroyed in the body or converted into inactive forms. Drugs which are not destroyed and are poorly excreted are cumulative.

Dosage.—Posology deals with the doses of drugs which are influenced by age and weight. Some people are over-sensitive to a drug and show an idiosyncrasy, that is they react to doses that would not affect the average person of their age and weight. Repeated administration of a drug may lead to tolerance, so that larger doses are required to produce the expected effect. Drugs having opposed actions may be antagonistic when given together, while two drugs having similar actions may be synergistic, enhancing each other's effects when given together, so that a smaller dose of each is required.

It is most convenient to classify drugs according to their actions on different organs.

Drugs acting on the Nervous System

Cerebrospinal Depressants.—These include general anaesthetics (Chapter 5), intoxicants, narcotics, analgesics, hypnotics and soporifics, anticonvulsants and antipyretics.

Intoxicants.—The chief intoxicant is ethyl alcohol. It depresses all parts of the central nervous system, its apparent stimulant effects being due to its inhibitory actions on the higher centres leading to a loss of self-control. The chief uses of alcohol

in medicine are as a solvent and vehicle for pharmaceutical preparations; as a skin disinfectant, astringent and counter-irritant; and as a reflex circulatory and respiratory stimulant due to its irritant action on the oesophagus. It also has a limited food value.

Narcotics and Analgesics.—A narcotic is a drug producing stupor or complete insensibility, while an analgesic is a drug relieving pain without loss of consciousness. Morphine, which is present in opium, combines both properties. It depresses the higher centres, leading to euphoria and sleep in quiet surroundings. The sensory areas of the brain are depressed, thereby the sensation of pain is eliminated or reduced. It also depresses the respiratory, cough and vasomotor centres in the medulla leading to respiratory depression and peripheral vasodilatation. The vagus centre and oculomotor centre in the medulla however are stimulated and cause a slight slowing of the heart and constriction of the pupil. In some animals and in children morphine stimulates the spinal cord and leads to convulsions. Morphine delays the emptying of the stomach and the passage of food down the intestine as a result of an increase in the tone of the muscle and a constriction of the sphincters. It has, therefore, a constipating action and is valuable in the treatment of diarrhoea. A high degree of tolerance and addiction develops with a prolonged use of morphine. Codeine is a derivative of morphine with less analgesic activity and a more selective action on the cough centre. It does not lead so readily to addiction, and it is used in the treatment of mild pain and to relieve a dry useless cough. Heroin (diacetylmorphine) is a very powerful analgesic, but it is a particularly dangerous drug since it readily produces a strong addiction. It may be used in small doses to depress the cough centre (Linctus diamorphine). Pethidine is a synthetic analgesic less powerful than morphine, but with a weak spasmolytic action that makes it particularly valuable in the treatment of spastic pains. It is a valuable drug in obstetrics and is also used in place of morphine for pre-operative medication. It can lead to addiction. Amidone ("Physeptone"*) is a powerful synthetic analgesic acting like morphine but free from its constipating action. N-allyl-normorphine ("Lethidrone") is a chemical derivative of morphine which antagonizes most of the actions of morphine and allied drugs and is used in the treatment of overdosage with these drugs. It is useless in barbiturate poisoning.

Hypnotics and Soporifics.—These drugs produce sleep and in smaller doses have a sedative action. They are used for the treatment of insomnia, in pre-anaesthetic medication and to

* Proprietary drugs are printed with an initial capital and are between inverted commas.

produce sedation. The barbiturate compounds are largely used. There are a large number of barbiturate compounds which may be grouped according to their duration of action.

Ultra-short-acting.—These act for about half to one hour. They include thiopentone ("Pentothal") and hexobarbitone ("Evipan"). They are largely used for light anaesthesia and in pre-anaesthetic medication.

Short-acting.—These act for 3 to 4 hours and include quinalbarbitone ("Seconal") and cyclobarbitone. They are used in insomnia to produce rapid and short sleep.

Medium-acting.—These act for 4 to 6 hours and include pentobarbitone ("Nembutal"), amylobarbitone ("Amytal"), butobarbitone and allobarbitone ("Dial"). They are used to produce hypnosis and long sleep, also as basal anaesthetics by rectal administration.

Long-acting.—These act for 10 to 12 hours and include barbitone and phenobarbitone. They are used to produce a prolonged sleep and, in smaller doses, for prolonged sedation in neurasthenia and thyroid disease and to reduce the frequency of epileptic convulsions.

Sedatives.—These drugs depress the functional activity of the nervous system. Bromides are chiefly used. They lessen nervousness and emotional excitability. They are only excreted *slowly*, and prolonged administration may lead to skin eruptions.

Analgesic-Antipyretics.—These relieve pain and lower body temperature, particularly in fever. The best known are the salicylates, particularly aspirin. Other coal-tar derivatives which are used include phenacetin, amidopyrine and acetanilid. They all have only mild analgesic properties but are particularly useful for the relief of headaches and neuralgic pains. They may be combined with codeine, for a stronger analgesic action. The salicylates are very effective in the relief of rheumatic pains, particularly in rheumatic fever.

Anticonvulsants.—These drugs act largely on the motor cortex and are used to control convulsions especially when they are refractory to bromides, and phenobarbitone. Of chief use are phenytoin ("Epanutin," "Diphenylhydantoin") and trimethadione ("Tridione").

Central Nervous System Stimulants.—These drugs stimulate the nervous system, increasing the activity of the brain and spinal cord. They include caffeine which stimulates first the higher centres, the stimulation spreading to the medulla and spinal cord with increasing doses. It is used to relieve depression, mental fatigue and headaches. It also stimulates the respiratory centre and may be used as a respiratory stimulant particularly in narcotic poisoning.

Caffeine stimulates the heart and dilates the coronaries. It also has a diuretic action (see page 114). Strychnine, in contrast, stimulates the spinal cord first, increasing reflex activity and in toxic doses leads to clonic convulsions. Its actions are antagonistic to the barbiturate drugs. Strychnine is said to have tonic properties, but this is due to its bitter taste stimulating the gastric juice and improving the appetite. Other respiratory stimulants are picrotoxin which readily leads to convulsions and is reserved for use in barbiturate poisoning, leptazol ("Metrazol," "Cardiazol") which is used in overdoses of narcotics and nikethamide which is weaker and is used in alcohol and morphine poisoning. Other stimulants of the central nervous system are amphetamine (see page 106) and atropine (see page 104).

Drugs affecting Sensory Nerve Endings.—These include Anodynes, which relieve pain on local application to the skin—magnesium sulphate solution, menthol, phenol, tincture of aconite, arnica and belladonna.

Local Anaesthetics.—These prevent the feeling of painful stimuli by paralysing sensory nerves. They may be applied to the sensory nerve endings by application to mucous membranes or injected under the skin. Local anaesthetics may also be applied to the nerve trunk itself, or to the sensory root ganglia where they enter the spine, thus producing a nerve block. Local anaesthesia can be obtained by occluding the blood supply by cooling by a spray of ethyl chloride or by the use of chemical substances. The first important chemical local anaesthetic was cocaine, an alkaloid in coca leaves. While it has a strong local anaesthetic action it is relatively toxic and, having a powerful stimulant action on the higher centres, readily leads to addiction. Cocaine combines a vasoconstrictor action with its local anaesthetic action. Other synthetic local anaesthetics do not combine this action, and adrenaline is included in solutions to localize their actions. These include procaine ("Novocaine"), amylocaine ("Stovaine"), butacaine ("Butyn"), amethocaine ("Pontocaine," "Anethaine"), cinchocaine ("Nupercaine") and lignocaine ("Xylocaine"). Procaine is as active as cocaine but much less toxic and is widely used; it has, however, a very weak action on mucous membranes. Amethocaine and cinchocaine are very powerful local anaesthetics; while they are more toxic than cocaine their greater potency gives them a greater safety margin. However, they should be used with care as absorption may lead to toxic effects. Benzocaine and orthocaine are insoluble powders and produce a prolonged effect. They are applied in dusting powders and ointments particularly to allay irritation as in pruritus.

Drugs acting on the Autonomic Nervous System.—To understand the actions of drugs which effect the autonomic

nervous system it is necessary to know something of its anatomy and functions.

The Autonomic Nervous System.—This system regulates the activities of plain muscle, which occurs in the blood vessels, lungs and gastro-intestinal tract; and the activities of various glands. Its functions are carried out automatically and are not under conscious control. The autonomic nervous system can be divided into two main divisions, the sympathetic and parasympathetic systems. In general the two systems have opposite and opposed actions, but this is not always so. The sympathetic nerves arise from cell stations situated in the thoracic and lumbar segments of the spinal cord, while the parasympathetic nerves arise from groups of cells situated in the mid-brain, pons and medulla (the cranial outflow) and also from the sacral segments of the spinal cord (the sacral outflow). The nerves of both systems are not continuous to the affected organs, but have junctions or ganglia in their paths. The nerves passing to the ganglia are preganglionic and join (or synapse with) nerves passing from the ganglia which are the postganglionic nerves. The parasympathetic ganglia are in close proximity to the affected organs, while the sympathetic ganglia are remote from the organ and in close proximity to the spinal cord. Thus, the actions of the parasympathetic nerves are more localized, while those of the sympathetic nerves are widely diffused. There is no actual anatomical junction between the pre- and postganglionic nerves in the ganglia, but the fine nerve fibres closely arborize with each other. Similarly, there is no actual junction between the nerve endings and the affected cells, but again a close interweaving of the fine nerve fibres and the affected cells. The important and amazing fact is that the transmission of the nerve impulse across these little gaps is brought about by chemical substances, whereas the nerve impulse travels along the nerve itself by electrical changes. Acetylcholine has been shown to be the chemical mediator at all parasympathetic nerve endings, which may be referred to as cholinergic nerves, while adrenaline and noradrenaline are liberated at sympathetic nerve endings and they are called adrenergic nerves. Acetylcholine is the mediator at all ganglia, both sympathetic and parasympathetic. These facts are illustrated in the following diagram (Fig. 46). In order that these chemical substances will not have a prolonged action, the body provides substances called enzymes which quickly destroy them after they have been released. The enzyme *cholinesterase* destroys acetylcholine and *amine oxidase* adrenaline and noradrenaline.

Drugs may act on the autonomic nervous system in the following ways:

(*a*) By stimulating or depressing ganglia;

(*b*) By stimulating or depressing parasympathetic nerve endings;

(*c*) By stimulating or depressing sympathetic nerve endings. In either of these last two cases the stimulation may be direct or through inactivation of the enzymes cholinesterase or amine oxidase.

It should be noted that it is not really the nerve endings themselves which are usually affected, but the parts of the tissues, called receptors, which are sensitive to the chemical substances.

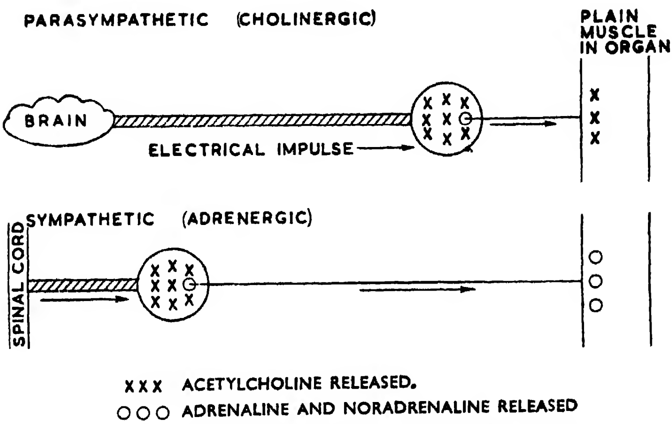


FIG. 46.—DIAGRAM SHOWING THE CHEMICAL TRANSMISSION OF NERVE IMPULSES.

This is important because denervated structures will still respond and often become more sensitive to the chemical substances when these are injected.

Drugs acting on Ganglia.—Nicotine was the first drug recognized to act on ganglia, and was used by Langley to trace the position of ganglia. It first stimulates and then paralyses the ganglia of both the sympathetic and parasympathetic systems. Its actions are therefore extremely complex and unpredictable so that nicotine is not used therapeutically. Toxic doses of nicotine cause death by depression of the respiratory centre.

Tetraethylammonium salts ("TEAB," "Etamon") and hexamethonium ("Vegolysen," "Hexathide," C6) have a purely depressant action on the ganglia. They are largely used to lower the blood pressure by removing the normal vasoconstrictor action of the sympathetic nerves. Hexamethonium is used to reduce haemorrhage during surgery of vascular areas. It is injected systemically and the operational area elevated.

Drugs acting on Parasympathetic Nerve Endings:

Stimulants.—These may act directly or by inactivation of the enzyme cholinesterase. While acetylcholine, the natural metabolite at parasympathetic nerve endings, may be given parenterally, it is so rapidly inactivated by cholinesterase that its action is too fleeting for any therapeutic usefulness. Acetyl-β-methylcholine ("Amechol") has actions similar to that of acetycholine, but these are much more prolonged. It has properties which appear similar to the effects of stimulating the parasympathetic nervous system. Thus it causes a slowing of the heart, vasodilatation and a fall in blood pressure, an increased secretion of sweat, saliva, gastric and bronchial secretions, a constriction of the bronchi and increased intestinal movements. It is used in paroxysmal tachycardia, paralytic ileus and to cause vasodilatation in vascular diseases. Its effects can be promptly antagonized and abolished by atropine. Carbamylcholine (carbachol, "Moryl") is a related compound. Pilocarpine, an alkaloid from jaborandi leaves, also stimulates parasympathetic nerve receptors and particularly stimulates secretions. It causes sweating (diaphoretic action) and salivation (sialagogue action).

Drugs stimulating Parasympathetic Nerve Endings by Inactivation of the Enzyme Cholinesterase.—Drugs which inactivate the enzyme cholinesterase prevent the breakdown of acetylcholine which is liberated from the parasympathetic nerve endings. They potentiate therefore the actions of acetylcholine. They include physostigmine (eserine), neostigmine ("Prostigmin"), di-isopropylfluorophosphonate (DFP) and tetraethylpyrophosphate (TEPP). Some of the anticholinesterase drugs are used as insecticides (e.g. Parathion) and they have potential uses as war gases. Toxic effects through the autonomic nervous system include an intense miosis, profuse secretions, bradycardia (slowing of the heart) and a fall in blood pressure. These drugs also affect motor nerves (see p. 106) and cause convulsions followed by paralysis. Physostigmine is used as a miotic in the treatment of post-operative ileus and functional tachycardia. Neostigmine has its most important effects on the motor nerve end-plate (see p. 107) and is used in myasthenia gravis. The effects of these drugs on the parasympathetic nerves are abolished by atropine, but not the effects on motor nerves.

Parasympathetic Nerve Depressants.—These include the solanaceous alkaloids, atropine, hyoscyamine, hyoscine (scopolamine) present in belladonna, and related plants. Synthetic drugs include homatropine ("Syntropan" and "Trasentin"). They block the actions of acetylcholine on the receptor cells and therefore prevent the effects of parasympathetic nerve stimulation and the actions of anticholinesterase drugs on the parasympathetic nerve transmission. Atropine is used pre-operatively to prevent

bronchial and salivary secretions and also to protect the heart from the slowing through reflex stimulation of the vagus nerve. Atropine prevents bronchospasm and is used in the treatment of asthma. It also has important uses in ophthalmology, dilating the pupil (mydriasis) and paralysing the ciliary muscles (cycloplegic action), so preventing the eye from focusing for near objects. Another use of atropine is to relieve spasms of smooth muscle (spasmolytic action) as in intestinal, renal and biliary colic. Atropine also combines a strong stimulant action on the central nervous system, and overdoses may cause convulsions. It has a stimulant action on the medulla, but there are better drugs for the purpose (see p. 100). Hyoscine has similar actions to atropine on the parasympathetic nerves, but differs in its central actions where it is purely depressant. It is used, therefore, for its sedative action in the treatment of delirium tremens and in acute maniacal states. It is used also pre-operatively, and in conjunction with morphine produces "twilight sleep." Hyoscine prevents motion sickness by depression of the vomiting centre. Homatropine has a much shorter action than atropine and is used as a mydriatic.

Drugs acting on Sympathetic Nerve Endings.—These act by (i) *stimulation*, or (ii) *depression*.

(i) *Stimulation.*—The chemical substance liberated at sympathetic nerve endings has been called sympathin. It is now known to be noradrenaline or adrenaline or a mixture of the two according to the particular nerve which is stimulated. It should be noted that stimulation of the sympathetic nervous system may be reinforced by the discharge of adrenaline from the medulla of the suprarenal gland.

Substances that stimulate sympathetic nerve receptors include adrenaline, noradrenaline, ephedrine, amphetamine and other related compounds which are called sympathomimetic amines.

Adrenaline.—This is a very potent substance. It has a strong stimulant action on the heart and constricts the blood vessels excepting those in the voluntary muscles. It causes, therefore, a rapid rise in blood pressure. It relaxes most forms of smooth muscle including those in the gastro-intestinal tract and the bronchi. It also raises the blood sugar. Adrenaline injected subcutaneously has a local vasoconstrictor action which is used to localize the actions of local anaesthetics, and also to stop bleeding (haemostatic effect). It is invaluable in the treatment of anaphylactic shock and in emergencies following allergic reactions such as in serum sickness and in bronchial asthma. It is also used in cardiac arrest and circulatory collapse.

Ephedrine.—This is a potent sympathomimetic drug with

accumulation of which in the blood provides the natural stimulus for breathing through the effects it has on the respiratory centre. It is usually given therapeutically as a 5 per cent mixture in oxygen. Oxygen is not itself a respiratory stimulant, but it is given when there is an oxygen insufficiency as in carbon monoxide poisoning, resuscitation from overdoses of anaesthetics, and in cases of drowning, heart failure and pneumonia. It is also given with volatile anaesthetics. Alcohol, camphor and ammonia are mile respiratory stimulants which act purely reflexly by stimulating the sensory nerve endings. Atropine, caffeine "Metrazol," nikethamide and picrotoxin owe their effects to their powerful stimulant action on the central nervous system (see p. 100).

Respiratory Depressants.—These are drugs which lessen respiration and they are largely depressants of the central nervous system. Respiratory depression is usually an undesirable side effect of drugs.

Expectorants.– These are drugs which promote bronchial secretion, and are used to aid the expulsion of mucus from the bronchial tract. They mostly act reflexly through irritation of the stomach and in larger doses have an emetic action. Important expectorants are ammonium salts, senega, squill and ipecacuanha. Iodides promote bronchial secretion through being excreted by the bronchial glands.

Respiratory Sedatives.—These are drugs which depress coughing. Morphine, codeine, heroin and methadone depress the cough centre, and are used for a dry useless cough. Demulcents such as liquorice, glycerin, honey and the benzoates (inhalation of friars' balsam) soothe the inflamed mucous membrane.

Bronchial Antispasmodics.—Are drugs which relax the constricted bronchi and are used to relieve bronchial asthma. They include adrenaline, ephedrine, atropine and the nitrites.

Drugs acting on the Heart and Blood Vessels

These include cardiac stimulants, cardiac depressants, vasoconstrictors and vasodilators.

Cardiac Stimulants.—These are drugs which increase the activity of the heart. They include adrenaline and other sympathomimetic amines and the cardiac glycosides.

The Cardiac Glycosides.—The important cardiac glycosides are digitalis, strophanthus and, to a lesser extent, squill. Digitalis consists of the leaves of the purple foxglove; it contains a number of glycosides including digitoxin, gitoxin and gitalin.

Digitoxin.—Is the chief one and is available in a pure crystalline form, but unfortunately it is not very soluble.

Digoxin.—Is a related crystalline glycoside obtained from another species of digitalis. It is soluble enough for injection. The use of the pure active principles is advantageous as they require no biological standardization and the absorption is more uniform than the mixed glycosides. There are a number of proprietary preparations of digitalis such as "Digitaline Nativelle" which consist of a mixture of the glycosides of digitalis and require biological standardization. The chief action of the cardiac glycosides is to increase the force of the heart beat and so increase the cardiac output particularly when it is deficient as in congestive heart failure. The heart rate is slowed through stimulation of the vagus nerve by digitalis. The excitability of the heart muscle is increased, so there may be extrasystoles when the dose is too high. The cardiac glycosides depress the conduction of impulses through the auriculo-ventricular bundle of His so producing heart block, thus they are used in auricular fibrillation to reduce the number of impulses reaching the ventricular muscle, enabling it to beat more slowly and more regularly. The use of digitalis in dropsy is due to its improving the circulation to the kidney, so facilitating the removal of fluid which has accumulated in the tissues. The effects of digitalis are slow in onset and once produced are persistent. There is, therefore, a danger of a cumulative action. After the initial dose, when the desired therapeutic effect has been obtained, the dose is reduced to maintain the action at a constant level. Symptoms of overdosage are bradycardia, headache, nausea, vomiting and extrasystoles.

Strophanthus.—Contains the glycoside G-strophanthin or ouabain which may be injected in a pure form and has a rapid onset of action which is useful in an emergency.

Cardiac Depressants.—These are drugs which depress the irritability and conductivity of the heart muscle, so prolonging the refractory period (the time following a stimulus during which the muscle is inexcitable). Quinidine is used to restore the normal rhythm in auricular fibrillation. If the fibrillation is of long standing, there is a danger of dislodging blood clots which may have formed in the auricle.

Vasoconstrictors.—These are drugs which constrict the blood vessels. Of chief importance are adrenaline, noradrenaline and other sympathomimetic amines (see pp. 105-106). Pitressin which is present in posterior-lobe pituitary extracts causes a prolonged vasoconstriction.

Vasodilators.—These are drugs which dilate the blood vessels. They include the nitrites, ganglionic blocking drugs (see p. 103) and depressants of sympathetic nerve endings (see p. 106). The nitrites include amyl nitrite, glyceryl trinit-

rate, sodium nitrite, erythrityl tetranitrate and mannityl hexanitrate. They are used to lower the blood pressure and to dilate the coronaries thus to improve the circulation in the heart, particularly in angina pectoris. They also relax the bronchi when they are constricted as in asthma. Amyl nitrite is inhaled and acts very quickly. Glyceryl trinitrate is used in the form of tablets which are placed under the tongue for sublingual absorption. Sodium nitrite has a much slower and prolonged action.

Drugs affecting the Blood

Haematinics.—These are drugs or substances that increase the haemoglobin and the number of circulating red blood cells. They are used in the treatment of anaemia. For the proper production of haemoglobin the body requires iron and traces of metals such as copper and cobalt. It also requires a factor which is present in liver, called vitamin B_{12}, or officially cyanocobalamin. Iron is present in many foods, especially meat, eggs and green vegetables. It is poorly absorbed from the intestine and relatively high doses of iron preparations are required over a period of time to be effective. The chief iron preparations are ferrous sulphate, ferrous carbonate (Blaud's pills), ferrous ammonium citrate and saccharated ferrous oxide; the last-named may be injected intravenously in patients refractory to iron by mouth. Deficiency of iron leads to hypochromic anaemia in which there is a deficiency of haemoglobin. It is more prevalent in women since reserve iron is lost from the body during menstruation. Ferrous phosphate which is present in Parrish's Food is a popular drug for giving iron to children.

Liver Preparations.—These are used in the treatment of pernicious anaemia which is due to a deficiency of vitamin B_{12}. This is present in liver extracts and may now be obtained in a pure form (cyanocobalamin) from liver or from the products of fermentation during the production of streptomycin. It is present in many foods but in some people a defect in gastric secretion prevents its absorption. Injection of liver extracts or pure cyanocobalamin, in the minute dose of one-thousandth of a milligramme, results in a rapid improvement. Injections need only be given at 6-weekly intervals.

Folic Acid.—This is also present in liver extracts and certain foods and can cure nutritional anaemias. However, it does not prevent spinal cord degeneration in pernicious anaemia.

Drugs affecting the Clotting of Blood.—Drugs which promote the clotting of blood are called coagulants. They include calcium, fibrin preparations, thromboplastin, vitamin K (and its synthetic substitutes menadoxime and menaphthone), and Russell's viper venom. Anticoagulants inhibit the clotting

of blood and include citrates, heparin, dextran sulphate, dicoumarol, ethyl biscoumacetate ("Tromexan") and certain dyes. Citrates are used during blood transfusion. They convert the calcium salts in the shed blood to an inert form; without calcium the blood cannot clot. Heparin appears to prevent the activation of prothrombin in the blood to thrombin, and is used in thrombosis and to prevent the clotting of shed blood. Dicoumarol is a synthetic compound which decreases the prothrombin content of the blood. Its action is slow and cumulative and daily determinations of the blood prothrombin are necessary. A derivative of dicoumarol is ethyl biscoumacetate, the effects of which are more easily controlled. Dextran sulphate acts like heparin. It should not be confused with dextran itself which is used as a blood plasma substitute.

Drugs acting on the Alimentary Tract

There is a large number of drugs that affect the movements and secretory activities of the alimentary tract. They include bitters, acids, carminatives, antacids, emetics, purgatives, astringents, adsorbents and anthelmintics.

Bitters.—These are substances which stimulate the taste-buds in the mouth, and reflexly stimulate the secretion of gastric juice in the stomach. They increase the appetite and aid digestion. The common bitters are gentian, quassia, calumba and bitter orange peel. The so-called tonic effects of small doses of quinine and strychnine (which is present in nux vomica) are due to their bitter taste.

Acids.—These are used to aid digestion where there is an insufficiency of acid in the gastric secretion. Pepsin, the gastric digestive ferment, is only active in an acid medium. Complete replacement therapy in complete lack of acid (achlorhydria) is impossible as the large amount of acid which is normally secreted in the stomach cannot be swallowed. Dilute hydrochloric acid is generally used and may be included with pepsin, e.g. glycerin acid pepsin.

Carminatives.—These are substances which expel gases from the stomach and intestines. They usually contain volatile oils; peppermint, cardamom, dill, chloroform water and aromatic spirit of ammonia are examples. Dill water is used effectively to relieve flatulence which is common in babies.

Antacids.—These are substances which are used to neutralize excess gastric acidity. The best antacid is milk. Chemical substances used include magnesium oxide, hydroxide and carbonate, sodium bicarbonate and calcium carbonate. The carbonates liberate carbon dioxide gas which stimulates the pro-

duction of more acid. The magnesium salts mentioned form magnesium chloride in the stomach which is laxative. Overdosage of alkalis causes alkalosis in which the plasma bicarbonate is abnormally high and the plasma chloride low; this leads to muscular twitching. Magnesium trisilicate does not liberate carbon dioxide, and is free from these objections. Aluminium hydroxide is very popular for the treatment of peptic ulcer; it is free from the previous objections and does not lower gastric acidity to a point where it interferes with digestion. It is also mildly astringent and demulcent and forms a protective lining to the irritated gastric mucous membrane.

Emetics.—These are drugs that induce vomiting. They are mostly used in an emergency to empty the stomach after ingestion of a toxic substance. The use of a stomach pump and the washing out of the stomach is to be preferred. Mustard and sodium chloride are usually available in the household as a first-aid measure. They act by reflex irritation of the mucous membrane of the stomach. Ipecacuanha has a similar action. Apomorphine, a synthetic derivative of morphine, has a selective action on the vomiting centre after it is injected. Emetics should not be used in corrosive or caustic alkali poisoning. In all cases particular care should be taken that the vomitus is not inspired.

Drugs affecting Intestinal Movements.—Drugs can affect the movement of the intestine either by stimulation or depression of the nervous mechanisms—the sympathetic and parasympathetic drugs; by a direct action on the muscle—posterior lobe pituitary extract, histamine; or by reflexly altering the peristaltic activity through irritation. The parasympathetic drugs, pilocarpine, carbachol and physostigmine are used to stimulate the gut in post-operative paralysis. Atropine, which antagonizes parasympathetic stimulation, reduces colonic movements and spasms of the intestine as in colic. The actions of morphine are discussed on p. 99.

Purgatives.—These are drugs which bring about an evacuation of the bowel. They may be classified as laxatives, which loosen the bowels and produce soft stools (cascara, rhubarb and senna); cathartics which produce loose watery stools (calomel, castor oil and phenolphthalein, magnesium and sodium sulphates); and drastic purgatives (colocynth, jalap and croton oil) which produce copious watery stools. In discussing them it is more convenient to classify them according to their mode of action.

Bulk Purgatives.—These act by increasing the bulk of the intestinal contents, and this can be effected by the addition of vegetables, fruit and cereals to the diet. Agar-agar, psyllium

seeds and certain cellulose preparations swell in contact with water and increase the bulk of the faeces. The saline purgatives, which include magnesium sulphate (Epsom salts) and sodium sulphate (Glauber's salt), retain water in the intestine where they are not absorbed and increase the osmotic pressure. They cause purgation in 1 to 2 hours and should be given with plenty of water.

Lubricants.—Liquid paraffin increases the bulk and also softens the stools due to its lubricant action. Prolonged administration of liquid paraffin interferes with the absorption of fat-soluble substances such as vitamin A.

Irritant Purgatives.—These increase the movement of the intestine through irritation of the mucosa. They include vegetable laxatives such as figs and prunes, also sulphur. Castor oil is a non-irritating oil which is broken down in the intestine liberating ricinoleic acid which is irritant and produces a soft stool in 3 to 6 hours. Senna, rhubarb, cascara and aloes contain an emodin substance which is only active on the intestine after it has been absorbed into the blood stream and broken down to liberate the active substance. These drugs do not act therefore for 8 to 10 hours, and are given overnight. Aloes also has a stimulant action on the uterus and is contra-indicated in pregnancy. Calomel and mercury with chalk (Grey Powder) are insoluble substances which are partly changed in the intestine to a soluble form which has an irritant action. Phenolphthalein is a common constituent of chocolate laxatives which are not without danger, since they are attractive to children. Phenolphthalein can cause repeated effects since it is reabsorbed and re-excreted in the bile. In a few individuals this drug may cause skin rashes.

Drastic or Hydragogue Purgatives.—These drugs all have an extremely irritant action on the small and large intestines and in excessive doses may cause ulceration. They produce copious watery stools in 2 to 3 hours which are often accompanied by griping and colic pains. They are usually combined with a drug such as hyoscyamus which inhibits the painful spasms of the intestine. Croton oil is a very drastic purgative and should be very rarely used. There is a danger with these drastic purgatives of severe irritation if the intestine should be mechanically obstructed. They are sometimes used to effect dehydration in oedema but this is not a very reliable procedure and the diuretics are to be preferred.

Astringents.—These are substances which precipitate protein on the surface of a mucous membrane or elsewhere. Vegetable astringents, especially kino, catechu and krameria, contain tannic acid which is slowly liberated in the intestine and forms a protective coating on the irritated mucosa. They are used in

the treatment of diarrhoea, usually in combination with opium.

Adsorbents.—These drugs attach toxic substances to their surface (adsorption) and are used to arrest diarrhoea. They include chalk, kaolin, bismuth carbonate, charcoal and magnesium trisilicate.

Anthelmintics.—These are drugs used to expel or paralyse and kill intestinal worms (Sec. IV, Chap. 1).

Drugs acting on the Urinary Tract

Drugs acting on the urinary tract include diuretics, antidiuretics, substances which alter the reaction of the urine, and urinary antiseptics.

Diuretics.—These are substances which increase the secretion of urine and aid in the removal of water, waste products and poisons from the blood. They are largely used to remove accumulated tissue fluid in oedema. They may be classified according to their mode of action. Caffeine and theophylline (aminophylline) increase the number of active secretory units (glomeruli) in the kidney, lessen tubular reabsorption in the kidney tubules and increase the blood flow through the kidney by dilatation of the blood vessels. Urea and saline substances such as sodium acetate and potassium citrate increase the osmotic pressure of the blood and urine, thereby withdrawing fluid from the tissues and increasing the amount of water secreted by the kidney. They should be given well diluted with water. Mercury is used in the less toxic organic form, e.g. mersalyl, and lessens reabsorption in the kidney tubules. It is often prescribed with theophylline. Since it is somewhat irritant it is contraindicated in chronic kidney disease. Digtalis and the cardiac glycosides are most effective in cardiac oedema and act indirectly through their cardiac action increasing the deficient blood flow to the kidney.

Antidiuretics.—These substances lessen the secretion of urine. Posterior lobe pituitary extract is commonly used when secretion of urine is excessive as in the disease diabetes insipidus.

Substances which alter the Reaction of the Urine.—These include ammonium chloride and sodium acid phosphate which make the urine more acid. In the case of ammonium chloride this is due to the ammonium part of the molecule being metabolized leaving the acid radicle. These drugs are used to inhibit the deposition of phosphate stones and they are also used in urinary antisepsis to activate hexamine and mandelic acid.

Substances making the urine more alkaline include sodium bicarbonate, and acetates, citrates and tartrates of sodium and potassium. In this case the acid radicle is metabolized

leaving the base. These substances are used in acidosis, in *B. coli* infections of the urinary tract, and also to counteract the irritant effects of acid urine excretion. They also facilitate excretion of urates, preventing the formation of urate stones.

Urinary Antiseptics.—These drugs are used to combat infections of the urinary tract. Potassium permanganate, gentian violet and colloidal silver preparations may be used locally against invading bacteria and as prophylactics. Internally, urinary antiseptics may be given by mouth or by injection, whence they are eliminated in the urinary tract. They include hexamine and mandelic acid, but these have now been largely replaced by the sulphonamides and the antibiotics which are much more effective (see Chapter 3).

Drugs acting on the Uterus

Of chief importance are the oxytocics which are used to contract the uterus and to check postpartum haemorrhage. Posterior lobe pituitary extract and the ergot alkaloids are chiefly used.

Posterior Lobe Pituitary Extract.—This contains the hormones derived from the posterior-lobe pituitary gland. It is prepared from the pituitaries obtained from the ox and sheep. The extract has been fractionated into vasopressin and oxytocin. Vasopressin ("Pitressin") contains a principle which contracts the blood vessels and has an antidiuretic action.

Oxytocin ("Pitocin") is the factor which contracts the uterus, stimulating the contractions and shortening the relaxation of the uterine muscle.

Ergot.—This is a fungus which grows chiefly on rye. It contains a number of alkaloids of which ergotoxine, ergometrine and ergotamine are of chief importance. These alkaloids contract the uterus and are given in childbirth after delivery to check uterine haemorrhage. Ergometrine, which is present in watery extracts of ergot, is very rapid in its onset of action, causing powerful contractions of the uterus within 6 minutes of its injection. It has only this one pharmacological action. Ergotoxine is slower acting and also has a vasoconstrictor action which in overdoses may cause gangrene. The eating of bread contaminated with ergot has caused gangrene and convulsions (St. Anthony's fire).

The Antihistamine Drugs

These are drugs which experimentally antagonize the actions of histamine on the tissues. They are used therapeutically in the

treatment of various allergic conditions such as urticaria, allergic rhinitis and serum sickness, which are believed to be due to the release of histamine by the tissues during the allergic reactions. A large number of antihistamine substances are available, differing in potency, duration of action and in their side effects. The commonest are antazoline ("Antistin"), diphenhydramine ("Benadryl"), mepyramine maleate ("Anthisan", "Neo-Antergan Maleate"), tripelennamine hydrochloride ("Pyribenzamine Hydrochloride"), promethazine ("Phenergan"), thonzylamine ("Neohetramine") and phenindamine ("Thephorin"). While they relieve the symptoms their use is only palliative and they should not replace desensitization procedures. Their use may be accompanied by unpleasant side-actions, particularly sleepiness, dizziness and nausea.

CHAPTER 2

VITAMINS AND HORMONES

THE VITAMINS. VITAMIN A. VITAMIN D. VITAMIN E. VITAMIN K AND MENAPHTHONE. THE VITAMIN-B COMPLEX. VITAMIN B1, ANEURINE OR THIAMINE. THE VITAMIN-B2 COMPLEX. RIBOFLAVIN OR LACTOFLAVIN. NICOTINIC ACID OR NICOTINAMIDE. VITAMIN C (ASCORBIC ACID). HORMONES. ACTION AND USES OF THE HORMONES. THYROID. PARATHYROID. INSULIN. PITUITARY. ANTERIOR PITUITARY. GROWTH HORMONE. THE LACTOGENIC HORMONE. ADRENOCORTICOTROPHIC HORMONE, OR ACTH. THYROTROPHIC HORMONE. THE GONADOTROPHIC HORMONES. POSTERIOR PITUITARY. THE ADRENAL HORMONES. THE SEX HORMONES. OESTROGENS. THE ANDROGENS. PROGESTERONE.

The Vitamins

VITAMINS are "accessory" food factors which are essential for normal metabolism in the tissues. In an adequate diet they are usually present in sufficient quantities for the maintenance of health, but " deficiency diseases " may develop when foods containing them are curtailed, or when disturbances of absorption or utilization arise. Vitamins are mostly unstable chemical compounds and are readily destroyed during cooking. Similarly, the source of vitamins may be removed during the modern processing of foods; examples are the removal of the germ in the production of wheat-flour, and in the polishing of rice. Fortunately, several of the vitamins can be synthesized cheaply and are added to foodstuffs, such as margarine. It is also fortunate that canned foods retain most of their vitamin content.

Deficiency of vitamins may also occur when absorption is decreased in certain conditions, such as persistent vomiting and diarrhoea, and when the absorption of fat is interfered with, as in coeliac disease and biliary obstruction.

There is an increased demand for vitamins during growth, pregnancy and lactation, also when metabolism is increased as in prolonged febrile conditions and thyrotoxicosis. It is under these conditions that administration of vitamin preparations is indicated and the lusty infants of the present day and the virtual absence of such diseases as scurvy and rickets provide ample

evidence of their value. We are perhaps over vitamin-conscious but fortunately their haphazard ingestion in reasonable doses produces no injurious effects, and they have a prophylactic value against possible deficiencies.

The vitamins are most conveniently classified according to their solubility, into the oil-soluble vitamins A, D, E and K, and the water-soluble vitamins B and C. Originally the vitamins could only be standardized by biological methods with animals and their potency was stated in units. A unit of activity refers to a stated amount of the International Standard Preparation for the preparation with which the test sample is compared. Today the vitamins, apart from the D vitamins, can be estimated by chemical or physico-chemical methods. Methods involving the growth of micro-organisms are also used (microbiological assays). Where the vitamin has been isolated in the pure form a statement of potency in units is obsolescent; such vitamin values are recorded in milligrammes and microgrammes.

Vitamin A.—This vitamin is present in animal fats including milk, cream, butter, egg yolk, liver and, as the carotene precursors from which it can be prepared by the body, in vegetables. Deficiency in vitamin A results in a lowered resistance to infections, retardation of growth and keratinization of the epithelial cells, particularly in the conjunctiva which becomes dry and wrinkled (xerophthalmia). An early manifestation is an inability to see in the dark, due to a failure to regenerate a pigment—the visual purple—in the retinal cells, by means of which we see in dim light. The daily requirements of vitamin A, 4,000 units, may be provided in 1½ teaspoonfuls of cod-liver oil, or 3 drops of halibut-liver oil which is much stronger.

Vitamin D.—Two D vitamins have been isolated. Vitamin D_2 (calciferol) is formed by exposing ergosterol, which is present in small amounts in many oils, to ultra-violet light. The body normally prepares this vitamin on exposure to sunshine, and exposure of the body to ultra-violet light will cure rickets. Vitamin D_3 is present in fish-liver oils, particularly in that of the cod and the halibut. The D vitamins are relatively stable and not destroyed by cooking. They are intimately connected with the absorption and utilization of calcium and phosphorus in the body. Deficiency of vitamin D in children causes rickets and in adults a softening of the bones called osteomalacia. This may occur during pregnancy when the demands for calcium are increased. The daily requirements of vitamin D are provided by 2 teaspoonfuls of cod-liver oil or 8 drops of halibut-liver oil, or it may be administered as calciferol in solution or tablets. Massive doses of vitamin D are used in the treatment of lupus vulgaris but care has to be taken to avoid toxic effects.

Vitamin E.—This vitamin is present in wheat-germ oil, in butter and in most greenstuffs. It is known as the fertility vitamin, since rats fed a diet deficient in vitamin E are unable to reproduce. Evidence for the need of vitamin E in man is doubtful, but there have been reports of its value in the treatment of habitual abortion.

Vitamin K and Menaphthone.—These promote the synthesis of prothrombin and reduce the clotting time of blood; they antagonize dicoumarol (see p. 110).

The Vitamin-B Complex.—This comprises a number of vitamins found together in yeast, embryos of grain and in greenstuffs, milk, eggs and liver. It includes a number of compounds of which the following are of most importance.

Vitamin B_1, Aneurine or *Thiamine.*—A deficiency of this vitamin may lead to beri-beri which occurs when polished rice (that is rice from which the embryo and husk have been removed) is eaten as the staple diet. The disease is characterized by a peripheral neuritis, muscle wasting and oedema. Aneurine is prepared synthetically and the daily dose is 1 mg. It may also be taken in the form of yeast and yeast extracts. Therapeutically, it may be used in the treatment of neuritis and gastro-intestinal disturbances as well as in beri-beri.

The Vitamin-B_2 Complex.—This includes riboflavin, nicotinic acid, pyridoxine, pantothenic acid, vitamin B_{12} and folic acid.

Riboflavin or Lactoflavin.—This vitamin occurs in yeast, milk, liver, eggs, fish, and can be made synthetically. Deficiency of this vitamin in animals leads to inflammatory lesions of the mucous membranes and skin, and in man to lesions of the lips, tongue, the skin of the face and the eyes. It has been seen after gastrectomy. The daily requirements are 3 mg.

Nicotinic Acid or Nicotinamide.—This vitamin is also called niacin (in U.S.A.) or the P-P factor. This vitamin occurs in yeast, milk and milk products, eggs, liver and cereals. Deficiency of nicotinic acid is associated with pellagra, which is characterized by alimentary and dermal lesions. Nicotinic acid is used in the treatment of glossitis, stomatitis, sprue and in the treatment of tongue lesions which may follow the oral administration of sulphonamides and the antibiotics and are probably due to sterilization of the intestinal flora which prevents bacterial synthesis. The minimum daily requirements are 10 mg. and doses of 40 to 50 mg. are given in pellagra.

Other B vitamins include pyridoxine and pantothenic acid, the need for which in man is not yet fully established, and vitamin B_{12} and folic acid; the two last-named have been described on page 110.

Vitamin C (Ascorbic Acid).—This vitamin is present in fresh

fruit, especially oranges, lemons, black currants and tomatoes. It also occurs in potatoes and green vegetables, but considerable losses occur in cooking. It is now readily prepared chemically. The average daily requirements of ascorbic acid are 50 to 100 mg. in the adult and 100 to 150 mg. in children up to five years. There is an increased demand during pregnancy and lactation. A breast-fed baby obtains about 40 mg. daily in the milk and this should be augmented by the administration of a concentrated source of vitamin C, such as that prepared from orange juice. Shortage of vitamin C decreases resistance to infections and gross deficiency results in scurvy, a disease characterized by multiple haemorrhages and a loosening of the teeth.

Hormones

Hormones are chemical substances which are secreted by endocrine glands or organs of internal secretion. They are secreted directly into the blood stream and only minute amounts are required to produce large physiological effects. The chemical structures of some of the hormones are known and they can be prepared synthetically. Others are protein-like in nature and they can only be obtained from biological sources. In some cases, as with the oestrogens, chemical compounds have been prepared synthetically. Since they have the definite advantage of being active by mouth they have largely replaced the natural product.

Action and Uses of the Hormones.—Hormones are usually administered when the activity of the gland itself is deficient, but they may also be used for definite therapeutic effect, as for example in the treatment of prostatic carcinoma with oestrogens. When the gland is over-active because of certain pathological conditions, it may be necessary to remove part of it. In some cases there are drugs which inhibit the formation of the natural hormone as in the use of thiouracil in the treatment of thyroid over-activity.

Thyroid.—The thyroid gland regulates tissue metabolism. It secretes the hormone thyroxine. For the production of the hormone iodine is essential, and a deficiency of iodine in the diet leads to an enlargement of the thyroid gland known as simple goitre, endemic goitre or Derbyshire neck. The condition is readily alleviated by the administration of small doses of iodine or iodides.

Under-activity of the thyroid gland, or hypothyroidism, causes myxoedema in the adult which is associated with a gain in weight, mental sluggishness and a dry puffy skin. In the infant it produces a cretin, or dwarf with retarded growth and mental development. Thyroid is administered in these cases

ENDOCRINE GLANDS AND THEIR HORMONES

Gland	*Hormones*
Thyroid	Thyroxine.
Parathyroid	Protein.
Pancreas (Islets of Langerhans)	Insulin.
Pituitary, Anterior Lobe	Growth hormone.
	Gonadotrophic hormones.
	(1) Follicle-stimulating (FSH).
	(2) Luteinizing hormone (LH).
	(3) Lactogenic hormone.
	Thyrotrophic hormone.
	Adrenocorticotrophic hormone.
Posterior Lobe	Oxytocic factor.
	Pressor factor.
Adrenal, Medulla	Adrenaline and Noradrenaline.
Cortex	Steroid ketones including Corticosterone, Desoxycorticosterone and Cortisone.
Gonads, Ovaries	α-Oestradiol.
Testes	Testosterone.
Corpus Luteum	Progesterone.
Placenta	Chorionic Gonadotrophin.

Modified from *Hormones: A Survey of their Properties and Uses.*
(*By courtesy of The Pharmaceutical Press.*)

either as the dried glandular extract or as the pure crystalline hormone, thyroxine, which is prepared synthetically. Treatment is controlled by determining the basal metabolic rate of the patient, in which the oxygen consumption or carbon dioxide production is determined at rest.

Over-activity of the thyroid gland, or hyperthyroidism, leads to exophthalmic goitre or Graves' disease. The gland is enlarged and the patient is a very nervous individual with an elevated metabolic rate and protruding eyeballs. In some cases a tumour is present (adenoma) when exophthalmos is usually absent. Iodine temporarily alleviates the condition and may be used pre-operatively to reduce the size of the gland. Certain drugs, mainly derivatives of thiourea, thiouracil and propylthiouracil, block the production of the thyroid hormone and alleviate the condition. They must be given over prolonged periods and the dosage carefully controlled.

Parathyroid.—The parathyroid glands lie close to or within the thyroid glands and their removal leads to a reduction in the blood calcium and tetany or muscular spasms due to hyperexcitability of the nervous system. The symptoms are alleviated by the administration of soluble calcium salts with calciferol. Extracts of the parathyroid gland, containing the hormone,

may be used, but after a time become ineffective. Over-activity of the parathyroid gland, hyperparathyroidism, which usually results from a tumour in the gland, raises the blood calcium. Calcium is withdrawn from the bones which become soft and bend. This is the cause of the rare disease osteitis fibrosa cystica.

Insulin.—Insulin is formed in the pancreas gland. This gland has a dual function for it elaborates the pancreatic juice in the serous acini which is important in digestion and is secreted into the small intestine. Insulin is formed in the islets of Langerhans and is secreted into the blood stream. Insulin is a protein-like material that can only be obtained from biological sources, from the pancreas of the ox or pig. It can only be standardized biologically. Insulin is of prime importance in carbohydrate metabolism and a deficiency in its secretion causes a high blood sugar and the appearance of glucose in the urine. These are the characteristics of the disease, diabetes mellitus, which is controlled by the injection of insulin. There are various preparations of insulin by the suitable choice of which its duration of action can be controlled. Ordinary insulin acts very quickly, but because of its short action two or three injections a day are necessary. By the combination of insulin with other proteins, *globin zinc insulin* and *protamine zinc insulin,* the action is prolonged, but is slower in onset, and ordinary insulin is indicated in diabetic coma. The dosage of insulin in the acute diabetic has to be carefully controlled with the diet and the patient carefully stabilized by blood sugar tests. Too much insulin causes hypoglycaemia, the symptoms of which are weakness, giddiness and even epileptiform convulsions. Glucose or sucrose by mouth rapidly alleviate the symptoms. Details of the use of insulin in diabetes have been described on p. 337. Insulin is also used therapeutically in the treatment of schizophrenia; this is known as insulin coma therapy.

Pituitary.—The pituitary gland is anatomically divisible into two distinct parts, the anterior lobe and the posterior lobe. Each secretes several hormones.

Anterior Pituitary.—The anterior pituitary secretes several hormones and has a control over the other endocrine glands. It has been called the leader of the endocrine orchestra.

Growth Hormone.—The anterior pituitary gland has an important effect on growth. Over-activity before the bones become set results in gigantism or the growth of giants, while in the adult, where the bones are set, the bones of the face and hands become enlarged; this condition is called acromegaly. Under-activity in children produces dwarfs with abnormal deposits of fat and undeveloped sexual organs, called Fröhlich's

syndrome, while in the adult there is an extreme obesity and suppression of the sex functions as in Simmonds's disease. Injections of growth hormone have been tried in the treatment of dwarfed children but have given poor results.

The Lactogenic Hormone Prolactin or Luteotrophin.—This hormone stimulates lactation, but its use clinically has been disappointing.

Adrenocorticotrophic Hormone, or ACTH.—This hormone affects the functions of the adrenal cortex. Its actions being mediated through the adrenal gland are dependent on functional adrenal tissue. It stimulates the production of cortical steroids and through the release of these has been found effective in collagen diseases, and is used in the treatment of rheumatoid arthritis, rheumatic fever, gout and lupus erythematosus. ACTH has also had a remarkable effect in certain eye diseases such as uveitis and choroiditis. It is necessary to use ACTH with care, as in spite of its dramatic effects it produces untoward side-effects typical of Cushing's syndrome, a rounding of the face, hirsutism and muscular weakness. (See also Cortisone, p. 124.)

Thyrotrophic Hormone.—This hormone stimulates the thyroid gland to produce more thyroxine, but it is of no clinical importance.

The Gonadotrophic Hormones.—These hormones act on the sexual glands, stimulating the ovaries in the female and the testes in the male to secrete their natural hormones. The *follicle-stimulating hormone* (FSH) stimulates the graafian follicles in the ovary and the germinal epithelium in the male. The *luteinizing hormone* (LH) maintains the corpus luteum during pregnancy. Extraction of these hormones from the pituitary gland is difficult, and in their place two similar hormones, produced by the placenta, are used. These are *chorionic gonadotrophin* which is present in pregnancy urine and forms the basis of pregnancy tests, and *serum gonadotrophin* obtained from the serum of pregnant mares. Chorionic gonadotrophin is mainly luteinizing in its actions, promoting the formation and maintenance of the corpus luteum, while serum gonadotrophin has predominantly a follicle-stimulating action in the female. The main clinical use of these hormones is in the male. Chorionic gonadotrophin stimulates the production of androgens, thus causing growth of the secondary sexual organs. It is used in the treatment of undescended testes (cryptorchidism) except where descent is impeded by an anatomical obstruction. Gonadotrophins have been used in various ovarian dysfunctions, such as functional uterine bleeding and amenorrhoea, but they have been largely replaced by the oestrogens and progesterone. Chorionic gonadotrophin is also used in threatened abortion, but its value is doubtful.

Posterior Pituitary.—Extracts of this gland have been fractionated into two parts. One fraction, *vasopressin* or "Pitressin," stimulates smooth muscle, particularly of the blood vessels and the intestine. It also delays the secretion of urine, antidiuretic action. Vasopressin is used to reduce urinary output in the disease, diabetes insipidus, and to raise the blood pressure and to stimulate the intestine post-operatively when there is distension and paresis. The other factor, *oxytocin* or "Pitocin" acts only on the uterus, stimulating uterine contractions (see page 115).

The Adrenal Hormones.—The adrenal or suprarenal glands contain two distinct areas of cells, the medulla which secretes the hormones adrenaline and noradrenaline, and the cortex which produces the cortical hormones. The actions of adrenaline and noradrenaline are described on pages 105 and 106.

The *adrenal cortex* is essential to life and adrenal cortical hormone deficiency is the cause of Addison's disease, which is characterized by a bronzing of the skin, loss of weight, muscular weakness and disturbances in mineral and carbohydrate metabolism. Hyperfunction of the adrenal cortex, usually due to a tumour, leads to sexual precocity, feminization in the male and virilism or male characteristics in the female. The hormones of the adrenal cortex are steroids, of chief importance being *desoxycorticosterone acetate* (DOCA), which is largely concerned with salts metabolism, and *corticosterone* which is concerned with carbohydrate metabolism. *Cortisone*, another adrenal steroid, has lately come into prominence because of its remarkable effects in rheumatic diseases. Both DOCA and cortisone are now prepared synthetically. DOCA is effective in Addison's disease, except in a crisis when it must be reinforced with adrenal cortical extract or cortisone. Cortisone is very effective in rheumatoid arthritis, in rheumatic fever, in Addison's disease, in inflammation of the eye, in disseminated lupus erythematosus, and in periarteritis nodosa. Prolonged administration of cortisone is associated with undesirable side-effects similar to Cushing's syndrome, a retention of water and sodium chloride and hirsutism. Treatment is not therefore persisted with for periods of more than 6 weeks at one time. Symptoms of the disease often return when administration is stopped.

The Sex Hormones.—These hormones are produced by the sex glands and are responsible for the sex processes and the development of the secondary sex characters which distinguish the male from the female. Their production is controlled by the gonadotrophic hormones secreted by the anterior pituitary gland. There are three main types:

(*a*) The oestrogens or female sex hormones;
(*b*) The androgens or male sex hormones;
(*c*) Progesterone, the hormone of the corpus luteum.

Oestrogens.—The natural oestrogens produced by the ovaries are *oestradiol* and *oestrone*. Oestrone is obtained from pregnancy urine, particularly from the mare; while oestradiol may be obtained from pigs' ovaries, or by synthesis from oestrone. *Ethinyloestradiol* is a highly active derivative of the natural oestrogen. The natural oestrogens are injected, usually in oil, by the intramuscular route, the benzoate or dipropionate being used for their prolonged action. Ethinyloestradiol is however active by mouth. The natural oestrogens have now been largely replaced by the synthetic oestrogens, *stilboestrol*, *hexoestrol* and *dienoestrol*, stilboestrol being the most active in the human. They are fully active by mouth. Oestrogens when injected into animals cause oestrus, or heat, even in ovariectomized animals, together with the associated changes in the uterus and vagina.

Clinically, oestrogens are used in conditions caused by oestrogen deficiency, for the treatment of menopausal syndromes, hypogenitalism and in functional uterine haemorrhage. They are useful in stopping lactation in non-nursing mothers, and in the treatment of gonorrhoeal vulvovaginitis in children. Oestrogens have been found valuable in the treatment of prostatic carcinoma, where they neutralize the male hormone and cause regression of the prostate gland which slows down the progress of the disease. They do not cure the condition, but prolong the expectation of life, and are used when operation is impossible. Some success has also been obtained with them in the treatment of mammary cancer.

The Androgens.—These hormones are secreted by the testes in the male and are responsible for the male sexual characters. They include *testosterone* and its derivatives. They are chiefly used clinically in hypogonadism in the male to promote growth of the genitals and control the secondary sexual characters in eunuchs. They may also be used in senility and in the male climacteric. They are of no value in sterility due to aspermatogenesis. They may be used in the female in chronic mastitis, and to suppress lactation. They have also been used in the treatment of cancer of the breast where they have a palliative effect.

Progesterone.—This is secreted by the ovary from the corpus luteum which is formed after ovulation and retained during the second half of the menstrual cycle. Progesterone causes proliferation of the uterine mucosa preparing it for implantation of the fertilized ovum. During pregnancy the corpus luteum is retained and assists in the maintenance of pregnancy. Progesterone may be obtained from sows' ovaries and is injected or implanted in the form of tablets in the treatment of habitual abortion. *Ethisterone* is a chemical compound having similar actions to progesterone but is active by mouth.

CHAPTER 3

CHEMOTHERAPY

DEFINITION. THE SULPHONAMIDES. MODE OF ACTION. ADMINISTRATION. TOXIC EFFECTS. MODE OF ADMINISTRATION. THERAPEUTIC USES. THE PROPERTIES OF THE MORE IMPORTANT SULPHONAMIDES. SULPHANILAMIDE. SULPHAPYRIDINE. SULPHATHIAZOLE. SULPHADIAZINE. SULPHAMERAZINE. SULPHADIMIDINE. SULPHACETAMIDE. SULPHAGUANIDINE. SUCCINYLSULPHATHIAZOLE. PHTHALYLSULPHATHIAZOLE. THE ANTIBIOTICS. DEFINITION. PENICILLIN. STREPTOMYCIN. AUREOMYCIN. TERRAMYCIN. CHLORAMPHENICOL. OTHER ANTIBIOTICS.

Definition

CHEMOTHERAPY may be defined as "the use of chemical substances in the treatment of infections." The chemical substance should be toxic to the parasite in doses or strengths that do not cause damage to the host's tissues; many substances that kill bacteria (disinfectants) are also toxic to the cells of the body.

The Sulphonamides

The first sulphonamide to be introduced in medical practice was "Prontosil," a red dyestuff, the activity of which was shown to be due to a part of the molecule, sulphanilamide. A wide range of derivatives of sulphanilamide are now available to the clinician.

Mode of Action.—The sulphonamides compete with para-aminobenzoic acid, a related chemical compound, which is an essential metabolite for the growth of bacteria. The bacteria ingest the sulphonamide in mistake for para-aminobenzoic acid and, as a result, their growth and multiplication are inhibited; this allows the body's natural defences to eliminate them. They do not actually kill the bacteria and are thus said to be bacteriostatic.

Administration.—The effectiveness of the sulphonamides in infections is dependent on the maintenance of an adequate and

stable blood concentration, also on the susceptibility of the infective organism. Initial doses are large, so that the organism has no time to become resistant; after which the blood level is stabilized by lower maintenance doses at sufficient time intervals. The availability of numerous sulphonamides of varying solubility and duration of action facilitates the maintenance of a stable blood level.

Toxic Effects.—Side-effects experienced with the sulphonamides include mental depression, vomiting, skin rashes, haematuria, methaemoglobin formation and drug fever. Symptoms vary with the individual.

Drug fever and skin rashes indicate sensitization, when no more sulphonamides should be given.

Another danger is the deposition of crystals of the sulphonamide or its acetyl derivative in the kidney. This is to be avoided by maintaining a high fluid intake—the administration of at least 6 pints of water a day—and keeping the urine alkaline in reaction. This crystal formation, termed crystalluria, is more liable to occur with the less soluble compounds, e.g. sulphapyridine, sulphamethazine and sulphadiazine. The risk of crystalluria is reduced by the administration of a mixture of sulphonamides (e.g. "Sulphatriad"), since the components do not reduce the solubility of each other and their respective bacteriostatic effects are additive.

Prolonged dosage with sulphonamides is to be avoided for there is a risk of agranulocytosis.

Mode of Administration.—The sulphonamides can be given orally or injected intramuscularly, intravenously, subcutaneously or intraperitoneally. They can also be applied locally as a powder, or in ointment form.

Therapeutic Uses.—The sulphonamides are effective against streptococcal, meningococcal, pneumococcal, gonococcal, staphylococcal and *Pasteurella pestis* infections. *Bacterium coli* infections also respond well. They are used in the treatment of septicaemia, meningitis, pneumonia, gonorrhoea, erysipelas, impetigo, plague and pyelitis. While they have to some extent been replaced by the antibiotics they are still widely used because of their cheapness and ease of administration.

The Properties of the more important Sulphonamides

Sulphanilamide ("Prontosil Album," "Streptocide").—This sulphonamide is readily absorbed in the gastro-intestinal tract. It is less active and more toxic than the newer sulphonamides, but its high solubility reduces the risk of crystalluria. It

is used in haemolytic streptococcal infections and non-gonococca genito-urinary infections.

Sulphapyridine ("M & B 693").—This sulphonamide is irregularly and poorly absorbed by the oral route. The low solubility of its excretory product increases the risk of crystalluria; and side-effects such as nausea and vomiting are common with this drug. It is effective against pneumococcal infections, but it has been largely replaced by sulphadiazine and sulphadimidine.

Sulphathiazole ("**Cibazol,**" "**Thiazamide,**" "**Wintrazole**").—This sulphonamide is rapidly absorbed, but it is also rapidly excreted, making it difficult to maintain an adequate blood level. While it is the most active sulphonamide it is very liable to cause toxic effects, especially drug fever. It is effective in the treatment of *B*-haemolytic streptococcal, pneumococcal, gonococcal, meningococcal, staphylococcal and *Bact. coli* infections. It is the sulphonamide of choice in the treatment of staphylococcal infections including sepsis, carbuncles and osteomyelitis, also in gonococcal infections. It is valuable for its rapid action in acute infections, after which treatment may be continued with sulphadiazine.

Sulphadiazine.—The absorption of this sulphonamide is not as rapid or as uniform as sulphathiazole. In these respects it resembles sulphapyridine. Excretion is also slower so that administration need not be so frequent as with sulphathiazole. It is generally well tolerated but care must be taken to avoid crystalluria by the maintenance of a large fluid intake and of urinary alkalinity. It is preferred to sulphathiazole and sulphanilamide for general use except in acute infections where therapy must be initiated by the parenteral route and the quicker action of sulphathiazole is to be preferred.

Sulphamerazine.—This sulphonamide resembles sulphadiazine in its properties, but it is more readily and completely absorbed by the oral route and adequate blood concentrations are readily attained. The excretion of sulphamerazine is slower than sulphadiazine so that smaller doses at less frequent intervals are required. It is less liable to cause crystalluria than the other sulphonamides. It is active against pneumococcal, streptococcal, meningococcal and gonococcal infections and, being soluble in neutral or acid urine, it is valuable in the treatment of *Bact. coli* infections of the urinary tract.

Sulphadimidine (Sulphamethazine).—This sulphonamide is rapidly absorbed by the oral route and is only slowly excreted. It rarely produces toxic effects and it is particularly suitable for children. Its high solubility reduces the risk of crystalluria, even in acid urine. It is valuable in the treatment

of lobar pneumonia, haemolytic streptococcal and *Bact. coli* infections of the urinary tract.

Sulphacetamide ("**Albucid,**" "**Steramide**").—This sulphonamide is very soluble and it is readily absorbed by the oral route. Excretion is also fairly rapid, mainly in the unchanged form. Sulphacetamide is well suited for the treatment of *Bact. coli* infections of the urinary tract. In the form of its sodium salt it is used for local application in solutions, ointments and creams, particularly in eye and naso-pharyngeal infections.

Sulphaguanidine.—This sulphonamide has a low solubility which reduces absorption; it is used for its local bacteriostatic action in the gastro-intestinal tract, particularly in bacillary dysentery. It has now been largely replaced by phthalylsulphathiazole and succinylsulphathiazole which are less absorbed and safer to use.

Succinylsulphathiazole.—This is a very insoluble compound which is used for infections of the gastro-intestinal tract such as dysentery. It also has an important use in the pre-operative preparation and post-operative treatment of patients undergoing operations on the large bowel where it reduces the bacterial content.

Phthalylsulphathiazole ("**Thalazole**").—This compound, like succinylsulphathiazole, is only slightly absorbed from the intestine. It has similar uses to succinylsulphathiazole but has a stronger bacteriostatic action.

It should be noted that sulphaguanidine, succinylsulphathiazole and phthalylsulphathiazole may suppress the synthesis of the B_2 complex vitamins in the small intestine by interfering with the bacterial flora. It is advisable therefore when administering these compounds over prolonged periods to give the vitamins of the B_2 complex at the same time.

The Antibiotics

Definition.—Antibiotics are substances produced by certain micro-organisms, mostly fungi, that inhibit the growth of other micro-organisms. Since penicillin was first discovered many other antibiotics have been isolated, but few of them have shown any definite advantages over penicillin and most of them have been found to be too toxic for use. Of chief importance are penicillin, streptomycin, aureomycin, terramycin and chloramphenicol obtained from fungi.

Penicillin.—Penicillin is obtained from the culture medium of the mould *Penicillium notatum*. There are a number of active principles, all closely related in chemical constitution, the one

of chief importance being benzylpenicillin (penicillin G), which is available in a pure form.

Penicillin is used in the form of its sodium, potassium or calcium salts or in the form of insoluble salts, such as procaine benzylpenicillin and the hydriodide of the diethylaminoethyl ester of benzylpenicillin ("Estopen"). The insoluble salts are used in order to delay absorption, and were at one time injected by the intramuscular route in a mixture of oil and beeswax, but today they are more frequently given as an aqueous suspension.

Properties.—Penicillin is a very unstable substance and solutions should be used within 4 days of preparation and should be stored in the intervening period in a refrigerator. Solutions are prepared by an aseptic technique since they cannot be sterilized by heat.

Administration.—Penicillin is largely destroyed in the alimentary canal and is only effective by mouth when given in very large doses. Administration is therefore usually by the parenteral route, usually intramuscularly, but it can be given intravenously, subcutaneously, intraperitoneally or intrathecally. For a local effect in the mouth and throat it can be given in the form of lozenges and for its effect in the lungs in the form of aerosols (vapours formed by a nebulizer). It is also used in the form of creams and ointments for application to wounds and to the eye. Absorption is rapid and penicillin is rapidly excreted so that frequent doses are necessary to maintain a constant blood level. However, if absorption is delayed by the use of the insoluble salts already mentioned, the injections can be reduced to two a day, or even less.

Toxicity.—Penicillin is not toxic, but some patients show an idiosyncrasy to it, resulting in allergic reactions such as urticaria and dermatitis. Skin reactions are more frequent following the external application of penicillin in ointments and creams. The antihistamine drugs are effective in treating the skin reactions.

Actions.—The actions of penicillin are largely bacteriostatic. It affects the growth and multiplication of bacteria in some way which is not known, thus enabling the leucocytes in the body to destroy them. The activity of penicillin is not affected by the presence of serum, pus or tissue proteins, nor is the phagocytic action of the leucocytes inhibited. Penicillin is predominantly effective against the Gram-positive organisms, including *streptococci*, *pneumococci*, *staphylococci* and *clostridium*. It is active against Gram-negative gonococci and meningococci, and against anthrax, leptospirosis, Vincent's infection, syphilis and actinomycosis. It is not effective against Gram-negative bacillary infections, viral infections, tuberculosis or amoebiasis (except

by virtue of its action on associated bacterial infections). In certain cases resistant strains may occur and these are becoming prevalent with the staphylococci.

Therapeutic Use.—In the treatment of infections due to organisms known to be sensitive to penicillin it should be given at once. If there is not a prompt response, it is advisable to make a bacterial examination since the infective organism may be of a penicillin-resistant strain. After intramuscular injections, maximal concentrations of penicillin in the blood are reached in 30 to 60 minutes and the blood concentration maintained by repeated injections or by the use of one of the long-acting preparations. If there is pus formation, surgical treatment and drainage are necessary. Penicillin is used in a wide variety of diseases. It is effective against haemolytic streptoccocal infections including cellulitis, mastoiditis and puerperal sepsis; against pneumococcal infections, including pneumonia, empyema, meningitis, gonorrhoea and staphylococcal infections; in syphilis, gas gangrene, actinomycosis and anthrax; and externally in wound infections, impetigo, dermatitis and in eye infections, including conjunctivitis, blepharitis and corneal ulcers.

Streptomycin.—This antibiotic is obtained from the culture medium of the fungus *Streptomyces griseus*. It is an alkaloidal glycoside which is used as the sulphate, chloride or calcium-chloride complex.

Properties.—Solutions of streptomycin are more stable than those of penicillin and they can be stored for 1 month in the refrigerator. Solutions of the sulphate and the calcium-chloride complex are incompatible and must not be mixed together.

Administration.—Streptomycin is not absorbed from the gastro-intestinal tract and it is only given orally for infections in the intestinal canal. Parenteral administration is usually by the intramuscular route, but it may be injected intraperitoneally or intracisternally. Streptomycin is readily absorbed and it is readily excreted so that doses are repeated at intervals of 3 to 6 hours. Absorption can be delayed by administering it in oil and beeswax. For its effects in the lungs aerosols of streptomycin may be inhaled.

Toxicity.—Streptomycin is more toxic than penicillin. It causes pain and tenderness at the site of the injection. Side-effects include headache, vertigo, nausea, vomiting and skin eruptions, particularly in sensitive persons. Skin rashes can usually be controlled with the antihistamine drugs. More serious effects of streptomycin are neurological disturbances including tinnitus, vertigo and deafness. After 2 to 3 weeks practically all patients show vestibular disturbances, and prolonged administration may cause deafness and permanent

damage to the 8th cranial nerve. Dihydrostreptomycin, a hydrogenated form of streptomycin, was introduced as being less toxic than streptomycin itself, but experience has shown that this is not so.

Actions.—Streptomycin is bacteriostatic and bactericidal and is active against a wide variety of Gram-negative organisms, including *Bact. coli*, *Pseudomonas pyocyanea*, *Pasteurella tularensis*, *Haemophilus influenzae* and *Proteus vulgaris*. It is also active against a number of Gram-positive organisms, but penicillin is to be preferred here. Unfortunately, bacterial resistance to streptomycin is rapidly acquired and seriously limits its usefulness.

Therapeutic Uses.—Streptomycin is of value for its effects on a wide variety of Gram-negative organisms and also against organisms resistant to penicillin. It is dramatically effective in the treatment of plague, tularaemia and *Pseudomonas pyocyanea* infections. It is also valuable in the treatment of bacterial meningitis and can be a life-saver in tuberculous meningitis. The chief importance of streptomycin is in the treatment of tuberculosis, where it suppresses the disease but it is not a cure. It is most effective in early pulmonary tuberculosis. The most beneficial effects have been obtained from combined treatment with streptomycin and para-aminosalicylic acid (PAS.). Treatment must always be prolonged with the danger of toxic effects and the development of resistant strains.

Streptomycin is effective in urinary tract infections due to Gram-negative organisms, where the urine must be maintained alkaline in reaction or the streptomycin is inactivated. Streptomycin may be given orally for intestinal infections, such as bacillary dysentery and acute enteritis, also to reduce the bacterial flora. With prolonged administration by mouth there may be avitaminosis and vitamins of the B_2 complex should be given during treatment. Externally solutions of streptomycin are applied to wounds infected with *Ps. pyocyanea* or *Proteus vulgaris*.

Today streptomycin is largely retained for its value in tuberculosis, and terramycin is taking its place in other infections.

Aureomycin.—This antibiotic is obtained from the culture medium of the fungus *Streptomyces aureofaciens*.

Properties.—Aureomycin is stable in acidified solutions but it is rapidly inactivated in alkaline solution.

Administration.—Aureomycin is usually administered by mouth at 6-hour intervals; but in an emergency it can be administered intravenously. Intramuscular injections are painful and are not used. It is rapidly absorbed from the gastro-intestinal tract and maximum blood levels are obtained in 6 hours. It is rapidly excreted by the kidneys.

Toxicity.—Aureomycin is relatively non-toxic, but it does cause side-effects including gastro-intestinal disturbances such as nausea, vomiting and diarrhoea. Allergic responses do occur and these may be relieved by the administration of antihistamines. Gastric irritation can be minimized by giving milk.

Actions.—Aureomycin has both bacteriostatic and bactericidal actions against a wide range of organisms including the rickettsiae and some viruses. Bacterial resistance rarely occurs.

Uses.—Aureomycin is effective against a large number of infections. It is used in bacterial infections due to Gram-positive or Gram-negative organisms, particularly when they are resistant to penicillin or streptomycin or when the patient is allergic to these antibiotics. Aureomycin is very effective against rickettsial infections such as scrub typhus and Rocky Mountain spotted fever. It is also effective against the venereal diseases, amoebiasis, and *Brucella*, pneumococcal, staphylococcal, streptococcal and bacillary infections. It is active in both acid and alkaline urines in urinary tract infections. It is also valuable in gastro-intestinal tract infections and being active against such a wide range of organisms it is used both pre- and post-operatively in surgery of the bowel. It can be a life-saver in peritonitis. Aureomycin is used externally in certain skin diseases and infections of the eye.

Terramycin.—This antibiotic is obtained from the culture medium of the fungus *Streptomyces rimosus*. It is normally used as the hydrochloride.

Properties.—The hydrochloride is soluble in water but it is only stable in acidified solutions. Solutions for intravenous use are usually freshly prepared.

Administration.—Terramycin is largely administered in capsules by mouth. It is readily absorbed from the gastro-intestinal tract and it is readily excreted by the kidney. Maximum blood concentrations are reached in 2 to 4 hours and doses are repeated every 6 hours.

Toxicity.—Terramycin is relatively non-toxic, but side-effects, such as gastro-intestinal disturbances, nausea, vomiting and diarrhoea may occur. Gastric irritation may be avoided by the administration of milk concomitantly.

Actions.—Terramycin, like aureomycin, is active against a wide range of organisms including the Gram-positive and Gram-negative bacteria, the spirochaetes, the rickettsiae and certain viruses. The development of bacterial resistance is rare.

Uses.—Terramycin is particularly effective in pneumonia, being active against both bacterial and viral forms. It gives good results in staphylococcal and streptococcal infections, *Brucella* and the rickettsial diseases. It is also used in urinary tract infections from various organisms including *Bact. coli*,

Bact. aerogenes and *Staph. aureus*. It has a definite advantage over streptomycin in the absence of toxic effects, ease of administration and the absence of development of bacterial resistance. It will probably replace streptomycin in all diseases except tuberculosis when it becomes more readily available. It cures gonorrhoea and is effective in syphilis but its long-term usefulness has yet to be proved.

Chloramphenicol ("Chloromycetin").—Chloramphenicol can be obtained from *Streptomyces venezuelae*. It is now largely prepared synthetically.

Properties.—Chloramphenicol is a fairly stable substance, solutions can be boiled and are stable at room temperature for a month.

Administration.—Chloramphenicol is usually administered in capsules by mouth. It can be given intravenously and intrathecally, but intramuscular injections are painful and irritant. Chloramphenicol is rapidly absorbed when given by mouth and maximum blood concentrations are reached in 2 hours. It is fairly rapidly excreted by the kidneys, largely in an inactivated form, and doses are repeated every 4 to 6 hours.

Toxic Effects.—Chloramphenicol has a low toxicity. Occasional untoward symptoms include nausea, gastritis, mild diarrhoea and dryness of the mouth. Recently, cases of aplastic anaemia and a few of agranulocytosis have been reported, during prolonged administration. This antibiotic should not be given for more than 2 weeks. Avitaminosis may also occur with prolonged dosage and simultaneous administration of vitamins of the B group is advisable.

Actions.—Chloramphenicol has both bacteriostatic and bactericidal actions against Gram-negative and some Gram-positive organisms, rickettsia and viruses. Resistance can develop with some strains of bacteria.

Uses.—Chloramphenicol is particularly valuable in the treatment of typhoid and paratyphoid fever. It is also effective in *Salmonella*, rickettsial diseases and brucellosis. It is useful in certain virus infections including virus pneumonia, psittacosis and herpes zoster. It is also used in urinary tract infections due to *Bact. coli*, *Proteus vulgaris* and *Pseudomonas pyocyanea*. It rapidly cures gonorrhoea. Externally, it can be applied in lotion or ointment form in wound and skin infections.

Other Antibiotics.—Other antibiotics of importance include Bacitracin, Polymyxin, Tyrothricin and Gramicidin. All are obtained from the culture media of bacilli and are relatively toxic. Their use is limited largely to local application to infected wounds and skin infections.

CHAPTER 4

INDEX OF MODERN THERAPEUTIC DRUGS

This chapter presents a short list of the more important modern therapeutic drugs, together with a brief indication of their uses and the doses that are usually employed. Most of them are official in the *British Pharmacopoeia* or the *British Pharmaceutical Codex* and they are listed under their approved names with the initials *B.P.* or *B.P.C.*, as the case may be, after them. Alternative and proprietary names follow between brackets. Manufacturers have introduced many proprietary names for these drugs or simple formulations of them. The more important of these have been included in their appropriate places and appear *between inverted commas*. In many instances the proprietary name is even better known than the official one, and is in fact the name by which the drug is usually known. It is, however, not a good practice to use the proprietary name, if for no other reason than because a drug is usually more expensive thus.

In order to save space and repetition we have not listed the proprietary names alphabetically, but should it be desirable, as it often will be, to look up a drug by its proprietary name, the latter will be found in the volume index, followed in each case by the official name and the page number on which the full description will be found.

The doses quoted are those officially recommended and they refer to the oral route except where specially indicated. The pharmacology of many of these drugs has been described in greater detail in the previous chapters and it is for this reason that some drugs, such as the sulphonamides and the antibiotics, have been omitted from this list.

Acetomenaphthone *B.P.* (Menadiol Diacetate, "Davitamon-K (Oral)," "Kapilon," "Kappaxan (Oral)," "Prokayvit Oral," "Vitavel-K (Oral)").—A vitamin-K analogue acting like menaphthone, but active by mouth. Dose $\frac{1}{30}$ to $\frac{1}{6}$ grain (2 to 10 m.g.)

Acetysalicylic Acid *B.P.* (Aspirin).—An analgesic and antipyretic. Dose 5 to 15 grains (0·3 to 1 g.).

Allobarbitone *B.P.C.* ("Dial").—A medium-acting barbiturate used in insomnia and anxiety states. Dose $\frac{1}{2}$ to 3 grains (30 to 200 mg.).

Aluminium Hydroxide Gel *B.P.C.* (Colloidal Aluminium Hydroxide, Aluminium Hydroxide Mixture, "Aludrox," "Alocol").—An aqueous suspension of aluminium hydroxide used as an antacid and protective in peptic ulcer. Dose 60 to 120 minims (4 to 8 ml.).

Amethocaine Hydrochloride *B.P.* (Butethanol, Pantocaine, Tetracaine, "Anethaine," "Decicain," "Pontocaine").—A strong local anaesthetic used for surface, infiltration and spinal anaesthesia.

Aminophylline (Theophylline with Ethylenediamine *B.P.*, "Aminomed," "Cardophyllin," "Diaphyllin," "Genophyllin").—Used as a cardiac stimulant and as a diuretic. Dose $1\frac{1}{2}$ to 8 grains (0·1 to 0·5 g.) orally or by injection.

Aminosalicylic Acid.—*See* Sodium aminosalicylate.

Amphetamine *B.P.*—Amphetamine base in special inhalers is used as a local vasoconstrictor for the nasal mucosa.

Amphetamine Sulphate *B.P.* ("Amphamed," "Benzedrine Sulphate").—Used to stimulate the central nervous system and to lessen fatigue. Dose $\frac{1}{24}$ to $\frac{1}{6}$ grain (2·5 to 10 mg.).

Amyl Nitrite *B.P.*—Inhaled from crushed capsules to cause immediate vaso- and coronary dilatation.

Amylobarbitone *B.P.C.* ("Amytal").—A medium-acting barbiturate used in insomnia. Dose $1\frac{1}{2}$ to 5 grains (0·1 to 0·3 g.).

Antazoline (Imidaminum, "Antistin," "Histostab").—An antihistamine drug effective in allergic conditions. Dose $1\frac{1}{2}$ to 3 grains (0·1 to 0·2 g.).

Apomorphine Hydrochloride *B.P.*—Stimulates the vomiting centre in the medulla and is used as an emetic. Dose $\frac{1}{32}$ to $\frac{1}{8}$ grain (2 to 8 mg.) by subcutaneous injection.

Arsphenamine (Salvarsan, "606"; "Stabilarsan" is a more stable preparation of arsphenamine diglucoside). This drug has been largely superseded by other arsenicals for the treatment of syphilis. While it is the most active compound the difficult technique required for its preparation for injection is unsatisfactory for routine use and accidents have occurred. The dose is $1\frac{1}{2}$ to 10 grains (100 to 600 mg.) by intravenous injection. The acid salt is dissolved in a large volume of water and neutralized to Congo red indicator by the addition of sodium hydroxide solution immediately prior to the injection.

Atropine Sulphate *B.P.* (*dl*-Hyoscyamine).—Stimulates and then depresses the central nervous system. It blocks the actions of the parasympathetic nerves preventing secretions and vagal slowing of the heart during anaesthesia, and relieves spasms of smooth muscle. In the eye it dilates the pupil and paralyses accommodation. Dose $\frac{1}{240}$ to $\frac{1}{60}$ grain (0·25 to 1·0 mg.).

Barbitone *B.P.* (**"Veronal"**).—A long-acting barbiturate used as a hypnotic and to induce sleep. Dose 5 to 10 grains (0·3 to 0·6 g.).

Barbitone Sodium *B.P.* (**"Embinal," "Medinal," "Veronal Sodium"**).—A long-acting barbiturate like barbitone but more soluble. Dose 5 to 10 grains (0·3 to 0·6 g.).

Benzalkonium Chloride (**"Roccal"**).—A disinfectant and detergent similar to cetrimide.

Benzyl Benzoate *B.P.*—Applied in the form of an emulsion in the treatment of scabies.

Butobarbitone *B.P.C.* (**"Soneryl," "Neonal"**).—A medium-acting barbiturate used in the treatment of insomnia. Dose 1 to 2 grains (60 to 120 mg.).

Caramiphen Hydrochloride (**"Parpanit"**).—A spasmolytic drug used in the treatment of parkinsonism. Dose $\frac{3}{4}$ to 10 grains (45 to 600 mg.) daily.

Carbachol *B.P.* (**Carbamylcholine Chloride, "Carbamed," "Moryl"**).—A stimulant of parasympathetic nerve receptors. Lowers the blood pressure and is used in the treatment of essential hypertension and paroxysmal tachycardia. Dose $\frac{1}{60}$ to $\frac{1}{16}$ grain (1 to 4 mg.) orally, $\frac{1}{240}$ to $\frac{1}{120}$ grain (0·25 to 0·5 mg.) by subcutaneous injection.

Carbarsone *B.P.* (**"Amabevan," "Leucarsone"**).—An organic arsenical compound used in the treatment of chronic intestinal amoebiasis. Dose 2 to 4 grains (0·12 to 0·25 g.) by mouth.

Carbromal *B.P.C.* (**"Adalin"**).—A mild and safe hypnotic for use in insomnia. Dose 5 to 15 grains (0·3 to 1 g.).

Caronamide (**Carinamide, "Staticin"**).—Used to reduce the tubular reabsorption of penicillin in the kidneys, so delaying excretion. Dose 30 to 60 grains (2 to 4 g.).

Cetrimide *B.P.* (**CTAB, "Cetavlon"**).—A bactericide and detergent used for cleaning and disinfecting wounds.

Chiniofon Sodium *B.P.* (**"Avlochin," "Quinoxyl," "Natrin"**).—Used in the treatment and prevention of amoebiasis. Dose 1 to 8 grains (60 to 500 mg.); 15 to 75 grains (1 to 5 g.) by rectum.

Chlorcyclizine Hydrochloride (**"Di-paralene," "Histantin"**).—An antihistamine drug with little side-effects. Dose $\frac{3}{4}$ to $1\frac{1}{2}$ grains (50 to 100 mg.).

Chloroquine Phosphate (**"Aralen Diphosphate." "Nivaquine"** is the sulphate).—This drug acts like mepacrine in human malaria. It is highly effective and well tolerated and does not produce gastric irritation or yellow discoloration of the skin. It is active against the asexual erythrocytic forms of *Plasmodium*

vivax and *P. falciparum*, but it is not active against the exoerythrocytic forms and does not prevent relapses in benign tertian (*vivax*) malaria, where it is used as a suppressive and in the treatment of acute attacks. It readily cures malignant tertian (*falciparum*) malaria where the exoerythrocytic forms do not persist. Chloroquine is given by mouth prophylactically in doses equivalent to 0·3 g. (5 grains) of the base weekly. In the treatment of an acute attack an initial dose of 0·6 g. (10 grains) is given, followed by an additional dose of 0·3 g. (5 grains) 6 to 8 hours later and 0·3 g. (5 grains) on 2 consecutive days after.

Cinchocaine Hydrochloride *B.P.C.* (Cincainum, "Nupercaine").—The most potent local anaesthetic. Used for surface, infiltration and spinal anaesthesia.

Codeine Phosphate *B.P.*—A mild analgesic and depressant of the cough centre. It is often used in conjunction with other analgesics, such as aspirin and phenacetin. Dose $\frac{1}{6}$ to 1 grain (10 to 60 mg.).

Corticotrophin (Adrenocorticotrophic Hormone, ACTH).—A hormone from the anterior pituitary gland which stimulates production of the cortical hormones from the suprarenal gland. Used like cortisone for rheumatoid conditions and certain allergic conditions.

Cortisone Acetate (Compound E, "Cortone Acetate").—A hormone isolated from the suprarenal cortex and now prepared synthetically. Used in rheumatic diseases, Addison's disease and allergic diseases. Dose $\frac{5}{6}$ to 5 grains (50 to 300 mg.) by mouth or intramuscular injection.

Crystal Violet *B.P.* (Medicinal Gentian Violet, Methylrosaniline Chloride).—Used externally in the treatment of burns, wound infections and skin diseases. It has a selective action against Gram-positive organisms. Internally it is used as an anthelmintic. Dose $\frac{1}{6}$ to $\frac{1}{2}$ grain (10 to 30 mg.).

Cyanocobalamin *B.P.* (Vitamin B_{12}, "Anacobin," "Cobione," "Megalovel," "Cytamen", "Euhaemon").—The antipernicious anaemia factor in liver extract. Dose initially 10 μg. once or twice daily until improvement in condition, followed by 10 μg. weekly by intramuscular injection.

Cyclobarbitone *B.P.C.* ("Phanodorm").—A short-acting barbiturate used as a sedative and hypnotic in insomnia. Dose 3 to 6 grains (0·2 to 0·4 g.).

Dapsone *B.P.C.* (DADPS, "Avlosulfon").—This compound is used in the treatment of lepromatous and tuberculoid leprosy. It is given orally in doses of (100 mg. 1½ grains) daily.

Decamethonium Iodide *B.P.* (C10, "Eulissin," "Syncurine").—A neuromuscular relaxant preventing the trans-

mission of motor nerve impulses. Used to produce muscular relaxation during surgical and manipulative procedures. Dose $\frac{1}{30}$ to $\frac{1}{12}$ grain (2 to 5 mg.) by intravenous injection.

Dehydrocholic Acid ("Certonin," "Dehydrocholin").—Used to increase the volume of bile. Dose 4 grains (0·25 g.).

Dexamphetamine Sulphate *B.P.C.* ("Dexedrine," "Drinamyl").—Acts similarly to amphetamine but is used mainly to reduce the appetite in the treatment of obesity. Dose $\frac{1}{12}$ to $\frac{1}{6}$ grain (5 to 10 mg.).

Dextran (Polyanhydroglucose, "Intradex").—Used as a substitute for blood or plasma to increase the blood volume in shock and dehydration.

Dextran Sulphate.—Has an anticoagulant action like heparin. It is still undergoing clinical trial.

Dicophane *B.P.* (Dicophan, DDT).—An insecticide effective against head and body lice and fleas.

Dicoumarol *B.P.C.* (Dicoumarin, "Temparin").—Inhibits the formation of prothrombin and lowers the coagulability of the blood. Dose $\frac{3}{4}$ to 5 grains (50 to 300 mg.).

Dienoestrol *B.P.*.—A synthetic oestrogen. Dose 0·5 to 10 mg. daily.

Diethylcarbamazine *B.P.C.* ("Banocide," "Hetrazan").—This drug is effective in the treatment of the tropical disease, filariasis, particularly infection with *Wuchereria bancrofti*. This disease is transmitted by certain species of mosquito and is characterized by elephantiasis of the arms, legs, breast or scrotum due to the worms accumulating in the lymph glands. The drug is given by mouth in doses of 0·5 to 2·0 mg. per kg. body weight over a period of from 3 to 22 days, and causes the microfilariae to disappear rapidly from the blood stream.

Digoxin *B.P.*.—A pure crystalline cardiac glycoside. Initial dose 1 to 1·5 mg. followed by maintenance dose of 0·25 mg.

Di-iodohydroxyquinoline *B.P.C.* ("Diodoquin," "Embequin," "Savorquin").—Used in the treatment of amoebic dysentery and other intestinal protozoal infections. Dose 5 to 10 grains (0·3 to 0·6 g.).

Dimenhydrinate (Anautinum, "Dramamine").—An antihistamine drug particularly effective in preventing motion and radiation sickness and the vomiting of pregnancy. Dose $\frac{3}{4}$ to $1\frac{1}{2}$ grains (50 to 100 mg.).

Dimercaprol *B.P.* (British Anti-Lewisite, B.A.L.).—Used in the treatment of arsenic, mercury and gold poisoning and in controlling toxic reactions to these metals when used therapeutically. Dose determined by the physician.

Diodone Injection *B.P.* ("Diodrast," "Perabrodil,"

"Pyelosil 35," "Pylumbrin").—An iodine compound used as an x-ray contrast medium for examination of the kidneys and urinary tract. Dose 300 minims (20 ml.) by intravenous injection.

Diphenan *B.P.* ("Butolan," "Oxylan").—This drug is used for the treatment of threadworm and pinworm infection (oxyuriasis). It is given in doses of 8 to 15 grains (0·5 to 1·0 g.) 3 times daily for 1 week, followed by a purgative at the end of the treatment. The course may be repeated 7 days later.

Diphenhydramine Hydrochloride ("Benadryl").—An antihistamine drug used in allergic conditions. It has some atropine-like actions as well. Dose $\frac{3}{4}$ grain (50 mg.).

Dithranol *B.P.* (Dioxyanthranol, "Cignolin").—Used for parasitic skin infections.

Emetine Hydrochloride *B.P.*—This drug is used in the treatment of amoebic dysentery, a disease caused by the presence of a protozoal amoeba in the body, *Entamoeba histolytica.* Emetine hydrochloride is irritant by mouth and is given by subcutaneous or intramuscular injections in doses of $\frac{1}{2}$ to 1 grain (30 to 60 mg.) daily. By mouth it is given in the form of Emetine and Bismuth Iodide *B.P.* in doses of 1 to 3 grains (60 to 200 mg.) daily. Emetine is a toxic drug, cumulative in its action and with prolonged administration may cause toxic effects on the heart and peripheral neuritis. Not more than twelve injections of 1 grain (60 mg.) should be given in any one course of treatment. While acute attacks of amoebic dysentery can be quickly cured by emetine, it rarely produces a complete cure. Patients continue to show cysts in their faeces and hence become carriers. Treatment is therefore usually combined with other drugs, e.g. "Diodoquin" or the arsenical drug, Carbarsone. Emetine is of chief value in the treatment of amoebic hepatitis and in amoebic abscesses.

Ephedrine Hydrochloride *B.P.*—Stimulates the sympathetic nerve receptors and the central nervous system. Used to raise the blood pressure and in asthma. Dose $\frac{1}{4}$ to 1 grain (16 to 60 mg.).

Ergometrine Maleate *B.P.* (Ergonovine Maleate).—Rapidly stimulates the uterus and used to prevent post-partum haemorrhage. Dose $\frac{1}{120}$ to $\frac{1}{60}$ grain (0·5 to 1·0 mg.) orally, $\frac{1}{240}$ to $\frac{1}{120}$ grain (0·25 to 0·5 mg.) by intramuscular injection.

Ergotamine Tartrate *B.P.* ("Femergin").—Used largely in the treatment of migraine. Dose $\frac{1}{60}$ to $\frac{1}{30}$ grain (1 to 2 mg.) by mouth, $\frac{1}{240}$ to $\frac{1}{120}$ grain (0·25 to 0·5 mg.) by subcutaneous injection.

Ethinyloestradiol *B.P.* ("Estigyn," "Ethidol," "Eticyclin," "Lynoral").—A synthetic oestrogen, the most potent known, and active by mouth in small doses. Dose $\frac{1}{3200}$ to $\frac{1}{600}$ grain (0·02 to 0·1 mg.) daily.

Ethisterone *B.P.* (Pregneninolone, Ethinyltestosterone, "Lutogyl Oral," "Oraluton," "Progestoral").—An orally active progestational substance. Dose 25 to 100 mg. daily.

Ethyl Biscoumacetate *B.P.* (BOEA, Pelentan, "Tromexan").—An anticoagulant acting like dicoumarol but more easily controlled. Dose determined by the physician.

Folic Acid *B.P.* (Pteroylglutamic Acid, "Folvite").—A vitamin of the B complex necessary for the formation of red blood cells. Dose $\frac{1}{12}$ to $\frac{1}{3}$ grain (5 to 20 mg.) daily.

Gallamine Triethiodide *B.P.C.* ("Flaxedil").—A synthetic muscular relaxant acting like *d*-tubocurarine. Dose determined by the physician.

Gamma Benzene Hexachloride *B.P.* ("Lorexane," "Gammexane").—An insecticidal compound. A 1 per cent alcoholic solution irradicates head lice and a 1 per cent emulsion is effective in scabies.

Heparin *B.P.*—The natural anticoagulant present in liver. Dose 6,000 to 12,000 units by intravenous or intramuscular injection.

Hexamethonium Bromide (C6, "Vegolysen;" "Hexathide" is the iodide).—A ganglionic blocking drug used to reduce the blood pressure and to reduce haemorrhage during operations, and for diagnostic purposes. Dose 4 to 8 grains (0·25 to 0·5 g.) orally, $\frac{3}{8}$ to $\frac{3}{4}$ grain (25 to 50 mg.) by subcutaneous injection.

Hexobarbitone *B.P.* ("Cyclonal," "Evipan").—A short-acting barbiturate used in insomnia. Dose 4 to 8 grains (0·25 to 0·5 g.).

Hexobarbitone Sodium *B.P.* ("Cyclonal Sodium," "Evipan Sodium").—Used intravenously as an ultra-short-acting barbiturate for short anaesthesia. Dose 3 to 15 grains by intramuscular or intravenous injection.

Hexylresorcinol *B.P.C.*—Used as an internal and external antiseptic, also an effective vermifuge. Dose 2 to 15 grains (0·12 to 1 g.).

Homatropine Hydrobromide *B.P.*—Has a similar action to atropine but is preferred in ophthalmology since it has a shorter duration of action.

Hyoscine Hydrobromide *B.P.* (Scopolamine Hydrobromide).—Acts like atropine on the parasympathetic nerve receptors preventing secretions and vagal slowing of the heart during anaesthesia. Unlike atropine it has a purely depressant action on the motor cortex and inducing sleep is more useful for pre-anaesthetic medication. Used with morphine it produces

"twilight sleep." Hyoscine also prevents motion sickness. Dose $\frac{1}{200}$ to $\frac{1}{100}$ grain (0·3 to 0·6 mg.).

Iodised Oil Injection *B.P.* ("Iodatol," "Lipiodol," "Neo-Hydriol Viscous," "Skiadin-Viscous").—Iodised poppy-seed oil used as a contrast medium for x-ray diagnosis particularly of the bronchial tract and for outlining internal cavities including the uterus and fallopian tubes.

Iodophthalein *B.P.* ("Opacin," "T.I.P.").—A contrast medium used for x-ray of the gallbladder. Dose $\frac{1}{3}$ to $\frac{1}{2}$ grain per lb. body weight up to 75 grains (40 to 60 mg. per kg. body weight up to 5 g.) intravenously. It can also be given orally.

Iodoxyl *B.P.* ("Pyelectan," "Urumbrin," "Uropac," "Uroselectan B").—An x-ray contrast medium used especially in intravenous pyelography. Dose 150 to 225 grains (10 to 15 g.) injected intravenously slowly over 5 minutes.

Isoniazid (*Iso*-Nicotinhydrazide, "Nydrazid," "Marsilid," "Pycazide," "Aldinamide," "J.N.H.," "Neumandin," "Vazadrine").—A derivative of nicotinic acid which is undergoing clinical trials in the treatment of tuberculosis.

Isoprenaline Sulphate *B.P.* (*Iso*-Propyl*nor*adrenaline, *Iso*-Propylarterenol, "Aleudrin," "Isupren," "Neo-drenal," "Neo-Epinine").—A stable sympathetic amine used for the relief of asthma. Dose $\frac{1}{6}$ to $\frac{1}{2}$ grain (10 to 30 mg.) sublingually or by inhalation.

Leptazol *B.P.* ("Cardiazol," "Centrazol," "Diovascol," "Metrazol," "Phrenazol").—Stimulates the mid-brain and the medullary centres. Used in respiratory failure and collapse during anaesthesia, also as an antidote in poisoning with narcotics particularly the barbiturates. Dose $\frac{3}{4}$ to $1\frac{1}{2}$ grains (50 to 100 mg.).

Lignocaine Hydrochloride (Lidocaine Hydrochloride, "Xylocaine").—A new local anaesthetic more potent but no more toxic than procaine. Used for infiltration, block and surface anaesthesia, usually in combination with adrenaline.

Lucathonium Hydrochloride *B.P.C.* (Miracil D, "Nilodin").—This drug is used in the treatment of schistosomiasis (bilharziasis), a tropical disease caused by a blood fluke *Schistosoma haematobium*, *S. mansoni* or *S. japonicum*, the cercariae of which penetrate the skin when a person bathes in infected waters. The cercariae mature in the liver and then the paired males and females migrate to deposit their eggs in the intestinal venules where they cause inflammation. This drug is given by mouth, night and morning, in doses of (1 g. 15 grains) for 3 days, followed by a second course 1 month later.

Magnesium Trisilicate *B.P.* ("Gastomag," "Magsor-

bent," "Novasorb").—An antacid and adsorbent used in gastric ulcer. Dose 5 to 30 grains (0·3 to 2·0 g.).

Menaphthone *B.P.* ("Davitamon-K," "Kappaxan," "Prokayvit," "Vitavel-K").—Used like vitamin K for promoting the formation of prothrombin in the body. Dose $\frac{1}{60}$ to $\frac{1}{12}$ grain (1 to 5 mg.) daily by intramuscular injection.

Mepacrine Hydrochloride *B.P.* ("Atabrine," "Atebrin," "Quinacrine").—This drug is used in the treatment of malaria. It acts against the erythrocytic forms but it does not act against the exoerythrocytic forms of benign tertian malaria and does not therefore prevent relapses. It is mainly used as a suppressive, but it is a cure for malignant tertian infections where the exoerythrocytic forms do not persist. Prolonged administration of mepacrine causes a yellow pigmentation of the skin. The drug is taken prophylactically in doses of 100 mg. ($1\frac{1}{2}$ grains) daily by mouth. Therapeutically the dose is from 200 to 500 mg. (3 to 8 grains) daily in divided doses.

Mephenesin *B.P.C.* ("Lissephen," "Myanesin").—Depresses the spinal cord, relaxing the voluntary muscles and antagonizing strychnine convulsions. It is used in parkinsonism, cerebral palsy, chorea, tetanus and strychnine poisoning. Dose 8 to 15 grains (0·5 to 1·0 g.).

Meprochol *B.P.C.* ("Esmodil").—Stimulates the parasympathetic nerve receptors and is used for postoperative atony of the gut. Dose $\frac{1}{20}$ grain (3 mg.) by subcutaneous or intramuscular injection.

Mepyramine Maleate *B.P.* (Pyranisamine, "Anthisan," "Neo-Antergan Maleate").—An antihistamine drug used in allergic conditions. Dose 5 to 12 grains (0·3 to 0·8 g.) daily.

Mersalyl *B.P.* (Mercurgan, "Merphyllin," "Salyrgan").—Used in the form of Injection of Mersalyl and Theophylline *B.P.* as a diuretic in cardiac oedema and nephrosis. The dose of the injection is 8 to 30 minims (0·5 to 2 ml.) by intramuscular or intravenous injection.

Methacholine Chloride *B.P.* ("Amechol Chloride," "Mecholyl Chloride").—Stimulates the parasympathetic nerve receptors. It produces vascular dilatation, slows the heart and increases the movement of the gut. Dose $1\frac{1}{2}$ to 3 grains (0·1 to 0·2 g.).

Methadone Hydrochloride *B.P.* (Amidone Hydrochloride, Dolophine, "Adanon Hydrochloride," "Physeptone").—A potent analgesic resembling morphine in its actions but causing less sedation. Contraindicated in obstetrics. Dose $\frac{1}{12}$ to $\frac{1}{6}$ grain (5 to 10 mg.) by mouth, subcutaneous or intramuscular injection.

Methylamphetamine *B.P.C.* (*d*-Deoxyephedrine, *d*-Desoxyephedrine, "Methedrine").—The base is used in inhalers to relieve nasal congestion. The hydrochloride restores the blood pressure in spinal anaesthesia, and like amphetamine it stimulates the central nervous system.

Methyldihydromorphinone Hydrochloride (Metopon Hydrochloride).—An analgesic twice as active as morphine and active orally. Dose 6 to 9 mg.

Methylthiouracil *B.P.*—An anti-thyroid drug acting like thiouracil but less toxic. Controlling dose 0·2 to 0·6 g. daily, maintenance dose 50 to 200 mg. daily.

Nalorphine (N-Allyl*nor*morphine, "Lethidrone").—An antagonist of morphine. Used as an antidote in overdosage with morphine, pethidine, amidone and related drugs. Dose 10 to 40 mg. intravenously, intramuscularly or subcutaneously.

Neoarsphenamine *B.P.* (Neosalvarsan, "Evarsan," "Novarsenobillon," "Novostab").—This arsenical compound has replaced arsphenamine in the treatment of syphilis, the solution being easily prepared. It has to be given by intravenous injection, intramuscular injections being painful. The initial dose is 7 to 10 grains (0·45 to 0·6 g.) at weekly intervals to a total of 100 grains (5 to 6 g.). The number of courses is determined by the serological reaction and they may be given in conjunction with, or alternated with, penicillin or with mercury and bismuth preparations. There is a 4 to 12 week interval between courses.

"Neostibosan".—This is a pentavalent antimony compound used in the treatment of visceral leishmaniasis (kala-azar) and cutaneous leishmaniasis (oriental sore). It is given in doses of 100 to 200 mg. ($1\frac{1}{2}$ to 3 grains) daily by intravenous or intramuscular injection for 8 to 16 days. It has also been successfully used in filariasis.

Neostigmine Bromide *B.P.* and Neostigmine Methylsulphate *B.P.* ("Prostigmin").—A cholinesterase inhibitor. Antagonizes curare and is used in the treatment of myasthenia. Dose of the methylsulphate $\frac{1}{120}$ to $\frac{1}{30}$ grain (0·5 to 2·0 mg.) by subcutaneous or intramuscular injection.

Nicotinamide *B.P.* (Nicotinic Acid Amide, Niacinamide).—It is used like nicotinic acid. Prophylactic dose $\frac{1}{4}$ to $\frac{1}{2}$ grain (15 to 30 mg.), therapeutic dose $\frac{3}{4}$ to 4 grains (50 to 250 mg.).

Nicotinic Acid *B.P.* (Niacin, "Davitamon-PP," "Pellagrin").—A vitamin of the B group, deficiency of which leads to pellagra. Prophylactic dose $\frac{1}{4}$ to $\frac{1}{2}$ grain (15 to 30 mg.), therapeutic dose $\frac{3}{4}$ to 4 grains (50 to 250 mg.) daily.

Nikethamide *B.P.* ("Anacardone," "Coramine," "Corediol," "Corvotone," "Nicamide").—Stimulates the medull-

ary centres and is used as an analeptic in collapse during anaesthesia and in overdoses of morphine and barbiturates. Dose 4 to 15 grains (0·25 to 1 g.) by injection.

Noradrenaline (Arterenol, Nor-Epinephrine, Sympathin N, "Levophed").—The natural mediator at sympathetic nerve endings. Causes vasoconstriction without increasing the heart rate and is used to raise the blood pressure in acute hypotension, shock, central vasomotor depression and haemorrhage. It is given in saline, dextrose or in blood by slow intravenous drip.

Orthocaine *B.P.* ("Orthoform").—An insoluble and long-acting local anaesthetic applied to the skin as a dusting powder or in ointment form.

Ouabain *B.P.* (Strophanthin-G).—A crystalline quick-acting cardiac glycoside. Dose $\frac{1}{480}$ to $\frac{1}{240}$ grain (0·12 to 0·25 mg.) by intravenous injection.

Oxophenarsine Hydrochloride *B.P.* ("Mapharside," "Mapharsen").—This arsenical compound is very effective in the treatment of the early stages of syphilis, rapidly causing the disappearance of spirochaetes, healing of lesions and a negative Wasserman reaction. It is effective in lower doses than neoarsphenamine and is less likely to cause toxic effects. It is given by a rapid intravenous injection initially, $\frac{1}{2}$ to $\frac{3}{4}$ grain (30 to 45 mg.), increasing to 1 to $1\frac{1}{2}$ grains (60 to 90 mg.). Injections are repeated every 3 to 4 days.

Pamaquin *B.P.* (Aminoquin, "Plasmoquine," "Praequine").—Pamaquin is used in the treatment of malaria and acts mainly on the gametocyte forms, having only a weak action against the erythrocytic forms. Its value is due to its destructive action on the persistent exoerythrocytic forms responsible for benign tertian malaria relapses. Its high toxicity limits its usefulness, the margin between the therapeutic and toxic dose being small. Pamaquin is not used alone or as a prophylactic. As a gametocide the dose is 10 mg. ($\frac{1}{6}$ grain) 3 times daily for 5 days preceded by a course of quinine or mepacrine. For the prevention of relapses 10 to 20 mg. ($\frac{1}{6}$ to $\frac{1}{3}$ grain) is given with 0·6 g. (10 grains) of quinine 3 times daily for 10 days.

Pentamidine Isethionate *B.P.C.*—This compound is used in the prophylaxis and treatment of African sleeping sickness, which is caused by infection with *Trypanosoma gambiense* or *T. rhodesiense* transmitted by the tsetse fly. It is only effective in the early stages, as the drug does not reach the cerebrospinal fluid in sufficiently high concentrations to be of value when the central nervous system is involved. Treatment consists of 10 intramuscular injections of 3 to 6 mg. per kg. body weight given every 24 to 48 hours as a 10 per cent solution. Pentami-

dine has also been found of value in the treatment of kala-azar.

Pentaquine.—This compound has similar properties to pamaquin to which it is chemically related. It is used in relapsing benign tertian malaria in doses of 10 mg. ($\frac{1}{6}$ grain) 6 times daily, together with 0·65 g. (10 grains) of quinine sulphate 3 times daily, over 14 days. This drug has toxic effects like pamaquin and is not used as a suppressive.

Pentobarbitone Sodium *B.P.* (**"Nembutal"**).—A medium- to short-acting barbiturate used in the treatment of insomnia and as a basal anaesthetic. Dose 1½ to 3 grains (0·1 to 0·2 g.).

Pethidine Hydrochloride *B.P.* (**Meperidine Hydrochloride, Dolantin, Isonipecaine, "Dolantal," "Demerol"**).—An effective analgesic used to replace morphine. It combines a spasmolytic action relieving spasm of smooth muscle. Valuable in obstetrics to relieve labour pains. Dose $\frac{3}{8}$ to 1½ grains (25 to 100 mg.).

Phenadoxone Hydrochloride *B.P.* (**CB11, "Heptalgin"**).—A powerful analgesic acting like methadone but having a shorter duration of action. Dose $\frac{3}{8}$ to $\frac{3}{4}$ grain (25 to 50 mg.). By subcutaneous and intramuscular injection $\frac{1}{12}$ to $\frac{1}{4}$ grain (5 to 15 mg.).

Phenazone *B.P.C.* (**Antipyrin**).—An analgesic and antipyretic. Dose 5 to 10 grains (0·3 to 0·6 g.).

Phenindamine Hydrogen Tartrate (**"Thephorin"**).—An effective antihistamine drug, not producing drowsiness. Dose $\frac{3}{8}$ to $\frac{3}{4}$ grain (25 to 50 mg.).

Phenobarbitone *B.P.* (**"Gardenal," "Luminal"**).—A barbiturate with a prolonged action, slow in onset. Used as a hypnotic and sedative in insomnia and in the treatment of epilepsy. Dose ½ to 2 grains (30 to 120 mg.).

Phenobarbitone Sodium *B.P.* (**"Gardenal Sodium," "Luminal Sodium"**).—This compound has similar properties to phenobarbitone but is more soluble and quicker acting. Dose ½ to 2 grains (30 to 120 mg.).

Phenylbutazone (**"Butazolidin"**).—This drug is undergoing trials in the treatment of rheumatic disorders. Dose 3 grains (200 mg.) by mouth 2 or 3 times daily; by intramuscular injection 15 grains (1 g.) every 2 or 3 days.

Phenytoin Sodium *B.P.* (**Diphenylhydantoin Sodium, "Dilantin Sodium," "Epanutin," "Eptoin"**).—An anticonvulsant drug used in the treatment of epilepsy, particularly in grand mal. Dose $\frac{3}{4}$ to 1½ grains (50 to 100 mg.).

Pholedrine Sulphate *B.P.C.* (**"Pholetone," "Stimatone," "Veritain"**).—A sympathomimetic amine used as a circulatory stimulant and vasoconstrictor. Dose $\frac{1}{8}$ to $\frac{1}{2}$ grain

(20 to 30 mg.) by intramuscular injection; $\frac{1}{12}$ to $\frac{1}{4}$ grain (5 to 15 mg.) by intravenous injection.

Picrotoxin *B.P.*—A central nervous system stimulant, used in particular in poisoning with barbiturate drugs. Dose $\frac{1}{100}$ to $\frac{1}{10}$ grain (0·6 to 6 mg.).

Potassium Hydroxyquinoline Sulphate *B.P.C.* ("**Chinosol**").—Used as an antiseptic, deodorant and spermicide.

Proguanil Hydrochloride *B.P.* ("**Paludrine Hydrochloride**").—This drug is one of the most generally used antimalarials, and it is important for its actions on malignant tertian infections where it acts against the exoerythrocytic forms of some strains. While it has no effect on the gametocytes in man, it subsequently affects their development in the mosquito and is therefore a suppressive. In benign tertian malaria proguanil is not a true prophylactic and does not prevent relapses. Proguanil is used prophylactically in doses of 100 mg. (1$\frac{1}{2}$ grains) daily, and in malignant tertian infections 0·3 g. (5 grains) of proguanil is given daily for 10 days, usually combined with mepacrine treatment.

Promethazine-8-Chlorotheophyllinate ("**Avomine**").—An antihistamine drug particularly valuable in the prevention of motion sickness. Dose $\frac{3}{8}$ grain (25 mg.).

Propamidine Isethionate *B.P.C.*—A bacteriostatic applied to surface wounds and burns.

Propylthiouracil *B.P.* (**Propacil**).—An antithyroid drug acting like thiouracil. Controlling dose 0·2 to 0·6 g. daily; maintenance dose 50 to 200 mg. daily according to the basal metabolic rate.

Pyrimethamine ("**Daraprim**").—This is a new antimalarial compound. The suppressive dose is 25 mg. weekly and for treatment the dose is 50 to 100 mg. ($\frac{3}{4}$ to 1$\frac{1}{2}$ grains) daily.

Quinalbarbitone Sodium *B.P.* ("**Seconal Sodium**").—A short-acting barbiturate used in insomnia and anxiety states. Dose $\frac{3}{4}$ to 3 grains (50 to 200 mg.).

Quinine.—Quinine is used in the treatment and prophylaxis of malaria, but it is being replaced by the more efficient synthetic compounds. It acts on the asexual erythrocytic forms. While it has a slight action on the gametocytes it is inactive against the exoerythrocytic forms and is not a true prophylactic. In the treatment of fever 10 grains (600 mg.) are given 3 times daily for 4 days or until the symptoms are relieved. As a prophylactic, or for the prevention of relapses, a daily dose of 10 grains (60 mg.) is used.

Quinine is also used as a "tonic," its bitter taste increasing the appetite.

Silver Protein *B.P.* (Strong Protein Silver, "Protargol").—An antiseptic applied to mucous membranes in 2 to 10 per cent solution.

Sodium Aminosalicylate *B.P.* (PAS, "Paramisan Sodium," "Aminacryl," "Bactylan").—A compound bacteriostatic against *Mycobacterium tuberculosis.* Most effective when combined with streptomycin treatment. Dose 180 to 300 grains (12 to 20 g.) daily in divided doses.

Sodium Aurothiomalate *B.P.* ("Myocrisin").—A gold compound used in the treatment of rheumatoid arthritis and non-disseminated lupus erythematosus. Dose $\frac{1}{8}$ grain (10 mg.), increasing gradually to $1\frac{1}{2}$ grains (100 mg.) weekly, by intramuscular injection.

Sodium Stibogluconate *B.P.C.* ("Pentostam," "Solustibosan").—This is a pentavalent antimony compound used for the treatment of leishmaniasis and it has also been used in the treatment of schistosomiasis and filariasis. A course of treatment is 400 to 600 mg. (6 to 10 grains) daily for 7 days by subcutaneous or intramuscular injection.

Solapsone *B.P.C.* ("Sulphetrone").—This drug is used like dapsone for the treatment of leprosy. It is also used in the treatment of pulmonary tuberculosis in combination with streptomycin. The dose for leprosy is 1·5 g. (20 grains) daily increasing to 3 g. (45 grains) daily by mouth. In tuberculosis the dose is from 5 to 10 g. (75 to 150 grains) daily, given in divided doses.

Stibophen *B.P.* (Fouadin).—This is a trivalent antimony compound used chiefly in the treatment of granuloma inguinale and schistosomiasis. It is injected in the form of Injection of Stibophen *B.P.* by the intramuscular or intravenous routes. The dose is 1·5 ml. on the first day, 3·5 ml. on the second day, 5 ml. on the third day and then every other day until a total dose of 40 to 75 ml. has been given. The course may be repeated after 2 to 3 weeks.

Stilbamidine Isethionate.—This compound is used like pentamidine for the treatment of trypanosomiasis and kala-azar. The dose is 1 to 3 mg./kg. body weight by intravenous injection. It is very effective, but is associated with unfortunate sequelae that limit its usefulness.

Stilboestrol *B.P.*—A synthetic oestrogen compound active by mouth. Dose 0·1 to 5 mg. daily.

Strophanthin-G.—*See* Ouabain *B.P.*

Sulpharsphenamine *B.P.* (Sulpharsenobenzene, "Metar-

senobillon," "Sulpharsan," "Sulphostab").—This arsenical is used like neoarsphenamine in the treatment of syphilis. It is less irritant and can be given by intramuscular injection. The dose is 1½ to 10 grains (0·1 to 0·6 g.) by subcutaneous or intramuscular injection.

Suramin *B.P.* (Germanin, Moranyl, Naganol, "Antrypol," "Bayer 205").—This drug is very active against the early stages of *Trypanosoma gambiense* and *T. rhodesiense*, which cause African sleeping sickness. It does not penetrate the central nervous system and is of no value when the central nervous system is affected. In the later stages of the disease treatment is usually combined with tryparsamide. The dose is 1·0 g. (15 grains) intravenously at intervals of 1 week up to a maximum of 5 g. (75 grains).

Suxamethonium Chloride (Succinylcholine Chloride, "Anectine," "Scoline"; "Brevidil M" is the bromide).—A neuromuscular relaxant acting like decamethonium but with a short duration of action. Dose $\frac{1}{240}$ to $\frac{1}{120}$ grain (0·25 to 0·5 mg.) per lb. body weight by intravenous injection.

Testosterone *B.P.*—The male sex hormone. Dose of the propionate 5 to 25 mg. daily by intramuscular injection.

Tetrachlorethylene *B.P.* (Perchlorethylene, "Tetracap").—This is the drug of choice for the treatment of hookworm infection. It is of little value against other worms. It is less toxic than carbon tetrachloride and in therapeutic doses it is harmless. The dose is 15 to 45 minims (1 to 3 ml.) given in the form of capsules which are swallowed whole in the morning on an empty stomach. It is followed 2 to 3 hours later by a purgative dose of magnesium sulphate to expel the worms. It is advisable to give a purge on the preceding day and to avoid fats and alcohol during treatment.

Tetraethylammonium Chloride *B.P.C.* (TEAC, "Beparon").—A ganglionic blocking drug used for reducing the blood pressure. Dose 15 to 75 minims (1 to 5·0 ml.) of a 10 per cent solution by intravenous injection.

Thiacetazone (Amithiozone, Thiosemicarbazone, "Berculon A," "Neustab," "Seroden," "Thioparamizone", "Benzthiozone").—This drug is used in the treatment of tuberculosis, usually in conjunction with streptomycin. Encouraging results have also been obtained in the treatment of leprosy. The dose is 25 to 50 mg. (½ to 1 grain) daily for the first week, gradually increasing to 100 to 200 mg. (1½ to 3 grains).

Thiomersalate *B.P.C.* ("Merthiolate").—A bacteriostatic and fungistatic used for instrument and skin disinfection and in the treatment of mycotic skin infections.

Thiopentone Sodium *B.P.* ("Intraval Sodium," "Pentothal").—An ultra-short-acting intravenous barbiturate injection for short operational and manipulative procedures and for the rapid induction of anaesthesia. Dose by intravenous injection 1½ to 8 grains (0·1 to 0·5 g.) intravenously.

Thiouracil *B.P.C.*—Used in the treatment of thyrotoxicosis where it blocks the production of the thyroid hormones. Dose 1½ to 3 grains (0·1 to 0·2 g.).

Thonzylamine Hydrochloride ("Neohetramine Hydrochloride").—A well-tolerated antihistamine drug. Dose ¾ to 1½ grains (50 to 100 mg.).

Tripelennamine Hydrochloride ("Pyribenzamine Hydrochloride").—An antihistamine drug used in allergic conditions. Dose ¾ grain (50 mg.).

Troxidone *B.P.* (Trimethadione, "Tridione").—An anticonvulsant drug used in the treatment of petit mal epilepsy. Dose 1½ to 6 grains (0·1 to 0·4 g.).

Tryparsamide *B.P.* (Glyphenarsinum).—This arsenical compound is very effective in the treatment of African sleeping sickness due to *T. gambiense* infection. The drug penetrates the central nervous system and is therefore also of value in the treatment of resistant cases of syphilis of the nervous system where it is often used after malaria therapy. It is not effective in primary or secondary syphilis. It is injected intravenously as a freshly prepared solution in doses of 15 to 30 grains (1 to 2 g.) for a course of 8 to 10 weekly injections. While the drug is not unduly toxic it is liable to impair the vision and must be used with care.

Tubocurarine Chloride *B.P.* (*d*-Tubocurarine Chloride, "Tubarine").—A relaxant of voluntary muscles by blocking the transmission of the nervous impulses at the motor nerve end-plate. It is used to produce muscular relaxation during surgical operations, electro-shock therapy and in orthopaedic manipulations. The dose is determined by the physician.

CHAPTER 5

ANAESTHESIA AND ANAESTHETICS

INTRODUCTION. ASSURING THE PATIENT. GENERAL PREPARATION OF THE PATIENT. PRE-OPERATIVE MEDICATION. ACCOMPANYING PATIENTS TO THE THEATRE. PRINCIPLES OF MODERN ANAESTHESIA. ANAESTHETIC AGENTS. 1. INHALANTS. 2. INTRAVENOUS INJECTIONS. 3. NERVE BLOCK. CARE OF THE PATIENT AFTER OPERATION. AIRWAY PROBLEMS. VOMITING. CYANOSIS. OXYGEN THERAPY. POST-OPERATIVE CHEST COMPLICATIONS. ENDOTRACHEAL TUBES. RYLE'S TUBE. INTRAVENOUS DRIPS. ANAESTHETIC EYE. CONCLUSION.

Introduction

WHILST it is widely known that new anaesthetic drugs and techniques have greatly widened the scope of surgery in the last 20 years, it is not so readily appreciated that these same drugs and techniques create risks and hazards that did not previously exist. A senior ward nurse must be conversant with the broad principles of modern anaesthetic procedures; she should know—what drugs have been administered to her patients; what undesirable results can follow; and how these should be treated.

In the following pages the writer has tried to discuss only the points that are applicable to nurses and to omit all else. However, a nurse working in a theatre or anaesthetic department would find it interesting and advantageous to learn more of the detailed work of the anaesthetist.

Assuring the Patient.—Most patients on arrival in a ward prior to operation are apprehensive, and fear of the anaesthetic is often their greatest worry. A few well-chosen words confidently delivered can be invaluable to such a patient. Often the knowledge that they will go to sleep after an injection, and that they will not have anything over their faces is all that they want to know. Do not overlook the fact that reassuring words from a patient who has had one or more anaesthetics are more convincing to a new arrival than any stock phrases uttered by the ward staff.

General Preparation of the Patient.—A good night's sleep should be ensured if possible before operation. Ideally,

patients should be questioned about their normal routine at bedtime; this will help a doctor to order the appropriate drugs for that particular patient.

Laxatives should not be given as a routine before operations, since with many patients the bowels will function naturally. Some patients will state that with a particular drug, which they are in the habit of taking regularly, they will get a bowel action by a certain time, and should this be a reasonable period before the operation their routine should be continued; otherwise the laxative should be omitted. For operations on the bowel the surgeon will give his own instructions. Neither food nor drink should be given for quite 4 hours before operation; otherwise vomiting may occur during the induction.

Before the patient leaves the ward, dentures, jewellery and watches should be removed for safety. Care should be taken to ensure that limbs do not overhang the trolley and so become exposed to possible injury.

Pre-Operative Medication.—This can be considered under two headings:

1. *Drugs that tend to dry up Salivary and Bronchial Secretions.*
2. *Hypnotic or Sedative Drugs.*

1. It is necessary to reduce secretions, as all anaesthetics, especially ether, increase the flow from salivary and other glands. Unless this flow is retarded the induction of anaesthesia may be made difficult by saliva in the mouth, coughing from profuse bronchial secretions and perhaps vomiting from increased gastric secretions. These drugs also block the vagus nerve to some extent and so help in preventing laryngeal spasm with light thiopentone anaesthesia, and cardiac irregularities arising from chloroform or during thoracic surgery.

Only two drugs produce a drying effect:

(*a*) Atropine which comes from the plant Belladonna. Dose $\frac{1}{200}$ to $\frac{1}{75}$ gr. hypodermically, 45 minutes before operation.

Toxic Effects.—Not normally seen.

(*b*) Scopolamine or hyoscine. This comes from hyoscyamus and other plants. Dose $\frac{1}{450}$ to $\frac{1}{150}$ gr. hypodermically, $1\frac{1}{2}$ hours before operation.

Toxic Effects.—In the aged and, if repeated, in younger persons, scopolamine will cause confusion and irrationality. For this reason the dose is reduced at about the age of 60 or replaced by atropine. Nurses should be aware of the possible effect as such a patient might fall when trying to get out of bed while in a confused state; therefore a patient showing this effect should not be left unattended until the effect has passed; this complication is more likely to occur before the anaesthetic than afterwards.

2. Hypnotics and sedatives are usually given from about the age of 2 years; by allaying anxiety they greatly reduce psychological trauma.

Adults may be given morphine $\frac{1}{6}$ to $\frac{1}{4}$ gr. hypodermically 1 hour before operation or more frequently "Omnopon" $\frac{1}{3}$ gr., an opium derivative, $1\frac{1}{2}$ hours before operation. Oral barbiturates or pethidine hypodermically are also given. The combination of "Omnopon" $\frac{1}{3}$ gr. and scopolamine $\frac{1}{150}$ gr. produces excellent sedation. Patients are relaxed and unapprehensive, and as a result of the scopolamine often have complete amnesia after the injection; they much appreciate this effect.

In the case of children, many anaesthetists prefer those between the ages of 2 and 10 years to come to the theatre asleep. Below this age they have a short memory of unhappy events, and when over 10 years they should be able to cooperate. Many techniques are used successfully, but, as in all paediatric work, extra care is necessary and the satisfactory results obtained are most gratifying.

From the barbiturate group, "Seconal" and "Nembutal" in a dose of $\frac{2}{3}$ gr. per stone body weight are commonly used. They can be given as a capsule or tablet with the minimum of fluid to drink (fluids cause vomiting), or as an elixir. Should restlessness occur in the recovery stage, an injection of "Nepenthe," less than 1 minim per year of age, will produce a quiet sleep after which all restlessness will have gone. A smaller dose of barbiturate is often prescribed, especially before minor procedures such as tooth extraction or tonsillectomy; here a dose of $\frac{1}{2}$ gr. "Seconal," regardless of age, produces valuable, if mild, sedation. Recovery from the anaesthetic is quicker than when a large dose is given. Rectal thiopentone, 1 gramme (gr. 15) per 50 lb. body weight, usually produces unconsciousness in 20 to 30 minutes; an additional dose may be prescribed after this time if the patient is not asleep. It is given as a 5 per cent solution in water, and as the volume is small it can be given in a short time; sometimes it is returned. Rectal paraldehyde is very effective in children. A dose of 1 drachm per stone body-weight as a 10 per cent solution in saline, maximum dose 8 drachms, seldom fails to produce unconsciousness.

N.B.—Care must be taken not to confuse ʒi (one drachm) for ℥i (one ounce); this fault has caused loss of life.

Accompanying Patients to the Theatre

A nurse who accompanies a patient to the theatre should know her duties and responsibilities and be forewarned that she will be taking over the case. The practice of sending at a moment's notice a junior probationer who has never seen the

patient previously, and who knows nothing of him, of ward nursing or of theatre technique, is deplorable. In such circumstances, a nurse may be frightened and demoralized through no fault of her own, so that she tries to avoid theatre work from then onwards.

The nurse should know the patient's name and age, the diagnosis and proposed operation, particularly which side is affected if the operation is unilateral; she should know what immediate pre-operative treatment has been carried out and the result, e.g. if a catheter has been passed and if it is still in place; or, if it has been removed, the time of removal and the quantity drained. She should know what pre-operative drugs have been given and the time of administration. She should ensure that patients are not moved from warm beds on to cold mackintosh sheets, and that in winter adequate coverings are supplied, or in hot weather that the thickness of the blankets is reduced.

Children who have lost consciousness may be only just asleep and if disturbed will wake and probably not go to sleep again. Talking to them should be discouraged, and trolleys should not be bumped in and out of lifts; the removal of a "teddy" and the straightening of bedding should be postponed until they have been anaesthetized.

In the anaesthetic room the nurse should be ready to help the anaesthetist and, even if an anaesthetic nurse is on duty, the ward nurse should only be absent with the anaesthetist's consent. Once in the theatre she takes her instructions from the theatre sister. Anyone entering a theatre during an operation should know the principles of theatre technique.

Principles of Modern Anaesthesia

For successful surgery the appropriate reflexes must be abolished. There are different stages of anaesthesia, and whilst some reflexes are abolished by light anaesthesia, others will be present until the deeper planes are reached. If ether or chloroform are used as the agents to produce deep anaesthesia, the patient will be up to 3 days recovering from the toxic effects of these drugs. Great efforts have been made to find less toxic substances that will abolish these reflexes. Local and spinal analgesia appeared to have succeeded, as they produced perfect operative conditions with minimal toxic effect on the patient. Long experience has disclosed however that other contra-indications exist, one of which is that most patients prefer to be asleep.

Today most patients are rendered unconscious with an intravenous dose of a barbiturate. This is not only pleasant, but in small doses has little or no toxic effect. If it is necessary to

abolish the deep reflexes this is done by a "relaxant" given intravenously, and after that the patient is kept asleep by nitrous oxide and oxygen supplemented perhaps by small quantities of some other drug or anaesthetic. From the patient's point of view this type of anaesthetic has little or no after-effects.

Anaesthetic Agents

Anaesthetic agents are of three main types:

1. *Inhalants.*
2. *Intravenous injections.*
3. *Nerve block.*

Inhalants

Gas Cylinders.—All cylinders have characteristic colours which are now universal. Those containing oxygen are black with a white top. Carbon dioxide is in a grey cylinder; if the oxygen is mixed with carbon dioxide the top is white segments and grey segments; nitrous oxide cylinders are blue. All nurses must know what these colours represent, particularly that of oxygen; failure to do this has caused loss of life because patients have been given the wrong gas.

Nitrous Oxide.—This is a weak, non-inflammable gas, which produces only light anaesthesia. Much skill is required to get good results with out-patient work, but the quick recovery which should follow its use in these cases is the reason why it is the routine method in most hospitals in the country. Mixed with 55 per cent air, it may be given by midwives to relieve labour pains. It is used in all types of surgery to keep the patient asleep whilst other analgesic and relaxant drugs largely produce the operative conditions required by the surgeon. An early return to consciousness at the end of the operation allows the patient to co-operate in post-operative routine care.

Ethyl Chloride.—This is an inflammable liquid which is powerful and toxic. It is usually given on a mask to induce unconsciousness in children. It is equally successful in adults if used in the same way.

Trilene.—This is a non-inflammable liquid, coloured blue' It produces a stronger effect than does nitrous oxide, especially in the field of analgesia. However, as it is not so safe as nitrous oxide, midwives may not use it when alone. A popular combination is Trilene with nitrous oxide and oxygen.

Ether.—Though inflammable this is a very useful anaesthetic with a wide range of safety. It is the anaesthetic of choice for the occasional anaesthetist. Owing to the irritant smell it is

not used for inductions. Deep ether anaesthesia is usually followed by vomiting and for some time afterwards the smell is

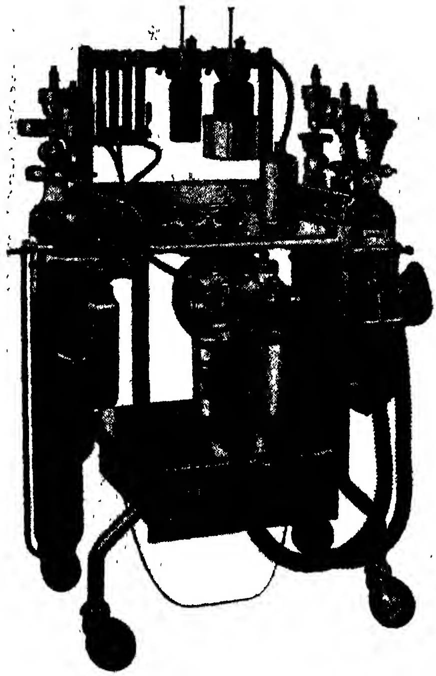


FIG. 47.—BOYLE'S COMBINED APPARATUS WITH CO_2 ABSORBER.

Illustrates a machine in common use. The cylinders are at the side and deliver gases to the flow meters situated top left at the back. From these the gases reach the chloroform and Trilene bottle, and then the ether bottle, whence they go to the patient. The closed circuit unit is underneath and, as illustrated, is ready for use if required.

(By courtesy of the British Oxygen Co. Ltd., London.)

nauseating to the patient; weak concentrations seldom have this effect.

Chloroform.—This non-inflammable liquid has the widest range of use of all the anaesthetics. It can be used to induce anaesthesia and to produce any depth of anaesthesia. It is not used much now because it may produce heart failure or liver damage.

Cyclopropane.—This is a powerful gas which is inflammable; it must be given with abundant oxygen. It may cause cardiac irregularities and should only be used in closed-circuit apparatus because of the high cost.

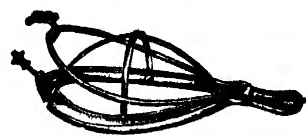


FIG. 48.—SCHIMMELBUSCH'S INHALER (Chadborn's Modification).

For use, some twelve layers of gauze are clamped in the frame. On this ethyl chloride, ether or chloroform may be used.

(By courtesy of the Surgical Manufacturing Co. Ltd., London.)

Intravenous Injections

Thiopentone Sodium.—This is widely used; it has the quickest action of all the barbiturates. Acting on the brain it depresses the higher centres causing unconsciousness and depression of respiration. When consciousness is regained the patient feels well though sleepy. Great care should be taken to ensure that any out-patient who has received this drug is fit to leave hospital and is accompanied by an adult friend or attendant; in no circumstances whatever should such a patient ride a cycle or drive a car.

Relaxant Drugs.—Curare (sold as " Tubarine "), was the first of this group and is still much used. It acts at the nerve endings which is where the nerve enters the muscle. By blocking impulses, partially or completely, there is little or no stimulus to make the muscle contract. This allows full relaxation of abdominal muscles and is equivalent to deep anaesthesia; however, pain stimuli are unaffected and they must be blocked by other means. When curare has been excreted no after-effects remain. "Prostigmin" is an effective antidote, working as it does in the opposite way to curare and at the same place. Atropine should be given before the " Prostigmin."

All relaxants affect the intercostal muscles and so respiration must be augmented in the theatre by compression of the bag of the anaesthetic machine. Whilst it is the anaesthetist's duty to ensure that respiration is adequate before the patient is returned to the ward these cases cause anxiety from time to time. Senior ward nurses should recognize deficient respiration in a patient; cyanosis is not a necessary accompaniment of this condition. The nurse should be able to check the adequacy of the airway and to give oxygen efficiently if it is required. She should inform the anaesthetist early if she is in any doubt about the patient's condition.

Analgesic Drugs.—Whilst repeated doses of thiopentone are given to cover pain stimuli, respiratory depression may cause difficulties later if much more than 1 gramme is given as a total dose.

Pethidine given intravenously produces analgesia and repeated doses are often given during long operations. It is unusual for respiratory depression to follow.

Procaine hydrochloride produces a similar result and can be given as an intravenous drip over long periods. As in normal doses neither of these drugs produces unconsciousness, each is usually preceded by thiopentone. These two drugs given in combination with weak nitrous oxide and oxygen allow patients to be returned to the ward awake, but without pain, after long operations. Further sedative drugs may not be necessary for some hours.

Nerve Block

Analgesia can be produced over small or large areas by injection of certain solutions which block the passage of pain sensations. This block may be produced:

1. On the surface of mucous membranes, e.g. the larynx and eye.

Solutions used. Cocaine 4 to 10 per cent.
Anethaine or "Butyn" 2 per cent.
Xylocaine 2 to 4 per cent.

2. By infiltrating all the operative field, e.g. sebaceous cyst or one tooth.

Solutions used. Procaine $\frac{1}{2}$ to 1 per cent
Amethocaine $\frac{1}{1000}$ to $\frac{1}{4000}$
Xylocaine 0·5 to 2·0 per cent
Nupercaine $\frac{1}{2000}$ to $\frac{1}{4000}$
} with or without adrenaline.

3. By blocking the nerve or nerves supplying a bigger area. Nearly all surgery can be performed in this way, especially if combined with some infiltration as well.

Solutions used.—As for infiltration but in greater strengths. Adrenaline causes vasoconstriction and delays absorption, thereby lengthening the time of action and reducing the toxicity; bleeding is also reduced. Adrenaline is supplied in the strength of $\frac{1}{1000}$, but is used in strengths as weak as $\frac{1}{250000}$.

Complications.—Though rare, complications may follow injections given to produce analgesia. Some out-patients feel faint and should be laid flat. It is wiser to start in this position if possible. Collapse and more rarely death can occur. Unconsciousness and convulsions follow overdosage, or if some analgesic has inadvertently been injected into a vein. The treatment of convulsions is by intravenous barbiturates. If too much adrenaline has been used, especially in the aged, gangrene of fingers and toes may follow surgery of these digits.

4. By injecting drugs into the cerebrospinal canal, segments

of the body can be rendered insensitive more quickly and with greater certainty than by blocking the individual nerves.

Solutions used. Nupercaine $\frac{1}{1500}$ (light).
,, $\frac{1}{200}$ (heavy).
Procaine 5 per cent solution
or
up to 200 mg. dissolved in cerebrospinal fluid.

For these injections and for diagnostic lumbar puncture all needles, syringes and ampoules must be sterilized by autoclaving. The needle is usually inserted through the space between the third and fourth or between the fourth and fifth lumbar vertebrae. Many different techniques are available to produce a successful block of the spinal cord, but all depend largely upon gravity to spread the drug over the required area. If a solution which is lighter than the cerebrospinal fluid is used, this will rise up the spinal cord if the patient is sat up, but will cause analgesia of the legs and pelvis if the patient is tipped head down. If a heavy solution is used the reverse will happen.

Complications of Lumbar Puncture.—Headache is the commonest and can be severe. Many anaesthetists want their patients kept flat on return from the theatre and perhaps the foot of the bed blocked for some hours; the patient can be made comfortable with one pillow at bedtime. Oral fluids should be minimal. Backache sometimes follows and may be treated by physiotherapy at a later date. Any infection within the dura is serious as meningitis may result. Temporary and permanent paralysis of muscles or groups of muscles has occurred.

Care of the Patient after Operation

Airway Problems.—It is of the greatest importance that the patient should be assured of an efficient airway until he recovers consciousness completely. The management of a patient's airway is basically simple; in breathing, air is drawn through the space at the back of the tongue (the pharynx) and then between the vocal cords and so into the trachea and lungs. The tongue is attached to the jaw and together they form a heavy mass (Fig. 49). When the muscles are relaxed during unconsciousness these two will fall by gravity. If the patient is on his back, the pharyngeal space will be lessened or obliterated (Fig. 50). Under these conditions breathing becomes difficult or impossible and cyanosis will follow. If the jaw is replaced to its normal position the pharyngeal space will be re-established (Fig. 51). This can usually be done in a patient with a normal complement of teeth by raising the chin. In the edentulous, however, this may not succeed and 3 fingers should be placed on each side

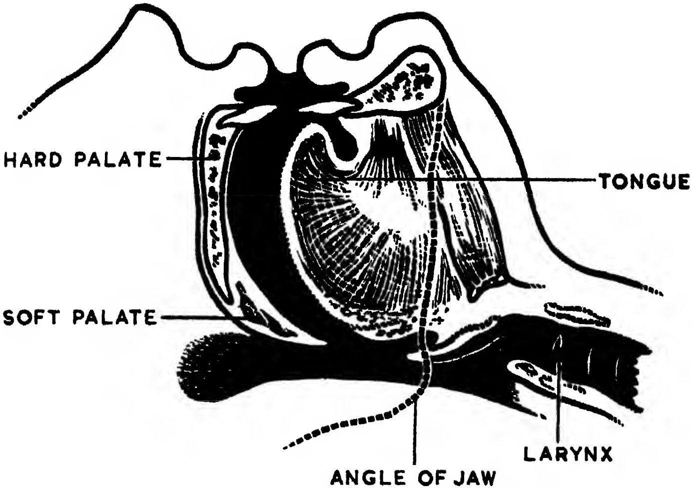
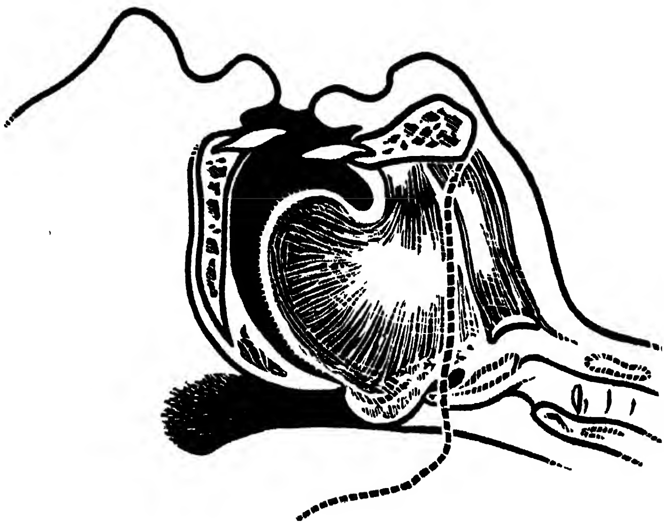


FIG. 49.—NORMAL POSITION OF JAW.



THE UNSUPPORTED JAW HAS FALLEN BACK AND AIRWAY IS OBSTRUCTED BY TONGUE

FIG. 50.

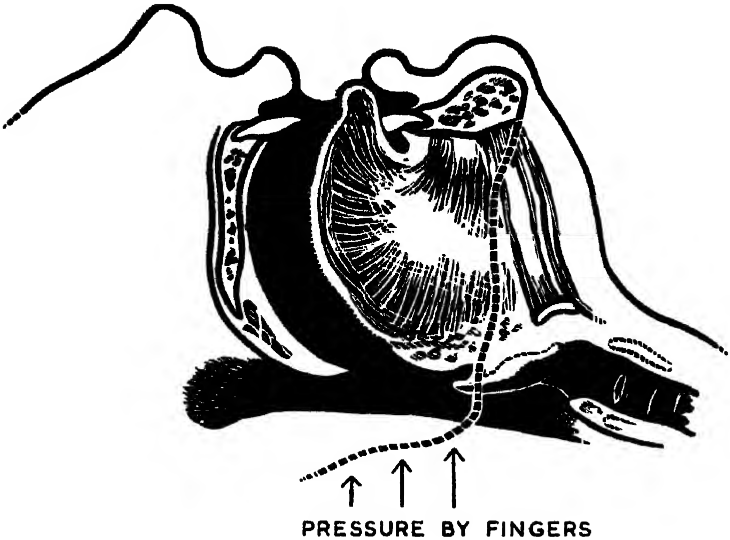


FIG. 51.

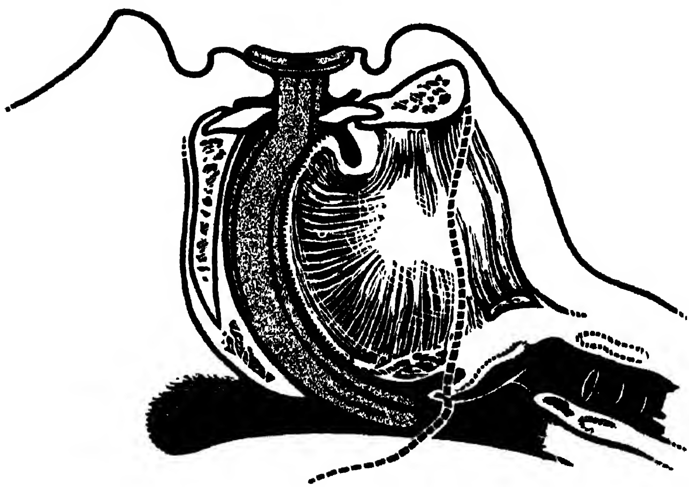


FIG. 52.—AIRWAY IN POSITION.

behind the ascending ramus of the mandible; pressure then exerted at right angles to the vertebral column will lift the jaw and the tongue. It is neither desirable nor necessary that nurses should routinely hold the jaw of unconscious patients. If the head can be positioned on one side and somewhat extended a perfect airway results in most cases. The adequacy of the airway should always be checked by listening for a good volume of air moving freely and without resistance. A more delicate test is to keep an eye open near the patient's mouth; the sensitive cornea will soon reveal how much breathing is occurring.

Air that has passed the pharynx will still fail to reach the lungs should the vocal cords be in spasm. The cords will shut as a result of reflex action that is there to protect the lungs from foreign bodies, etc. This is what happens when food "goes the wrong way." In the ward, spasm can occur if the patient vomits or has blood or saliva in the mouth, but most frequently it is because an artificial mouth airway, which was inserted when he was in the theatre, has been left in for too long. This should be removed when the patient shows signs of returning consciousness. These signs may be swallowing, movement of facial muscles or movement of a limb. Laryngeal spasm will be accompanied by a high-pitched note on inspiration. Nurses should be able to identify this noise whenever they hear it and should go immediately to the patient. An artificial airway, if present, should be removed and then the jaw held in the best position to allow free breathing. Normal conditions are soon re-established if prompt treatment is given.

Vomiting.—There are no precise instructions for this serious situation. Treatment aims at drainage of the vomitus whilst a free passage for air is maintained. Quick action is essential. Drainage can be obtained by removal of all pillows, turning the head to one side or by turning the patient on to his side. The jaw should then be held as in Fig. 51. Greater stability is obtained in the lateral position if the lower knee is well flexed. Raising the foot of a bed or tilting a trolley are additional helps to prevent aspiration of vomitus. Routinely patients should be nursed in the lateral position after surgery on the nose or throat.

Mouth gags and tongue forceps are of limited use and should usually be avoided; many teeth have been dislodged and many tongues have been split by these instruments without any corresponding benefit to the patient. A nurse who has learned to depend on them is at a complete loss if they are not available and is apt to lose valuable time in procuring them. A porringer or dish is seldom a practical receptacle to catch vomitus; the mess is usually less if a towel is pushed under the chin and spread in

front of the patient. Should cyanosis persist after vomiting the possibility of tracheal or bronchial obstruction should be considered and the anaesthetist informed immediately. Post-operative vomiting often occurs when a patient is allowed to drink a cup of fluid; drinks should be limited to sips which may be given frequently.

Cyanosis.—This will occur when there is a certain percentage of reduced haemoglobin in the blood. Normally it indicates oxygen want, but an anaemic patient can collapse and die before cyanosis develops. The commonest causes of post-operative cyanosis are blockage of air passages by the jaw, tongue, foreign bodies, etc., and from deficient power of ventilation resulting from relaxant drugs and barbiturates, and from shock. The treatment is to ensure a good airway and to give oxygen.

Artificial respiration will also be performed if necessary.

Oxygen Therapy.—Only one-fifth part of the air that we breathe is oxygen, but this is fully adequate for all normal requirements, and gives almost complete saturation of the haemoglobin. If pure oxygen is inhaled the same volume of inspired air contains five times as much oxygen; this is especially important if there is depressed respiration.

In other conditions such as shock and haemorrhage improvement follows oxygen therapy because more oxygen is then dissolved in the plasma and is taken to the tissues in solution. Except when a tent is used the oxygen is inevitably mixed with some air and the efficiency of the method is reduced when much air is breathed at the same time, as with Tudor Edwards' spectacles. A nurse should ensure that a flow of about 5 litres per minute is leaving the cylinder, and that there are no loose joints, perished tubing or displaced corks which prevent the same flow from reaching the patient.

Post-Operative Chest Complications.—These arise from many causes; pre-existing disease of the lung, the nature and extent of the operation and the kind of anaesthetic, are obvious causes. The nurse, too, has an important rôle. Pre-operatively the correct use of a Ryle's tube, especially in cases of small bowel obstruction, will ensure against regurgitation of stomach contents into the lungs. By ensuring that adequate time is allowed for premedication to dry the secretions, an over-moist lung is avoided. If adequate time does not exist, and it is otherwise appropriate, the anaesthetist might prefer to give the drugs intravenously.

Post-operatively the nurse must prevent aspiration of vomitus or blood. Conscious or unconscious patients should not be left for hours in the same position as this causes lung secretions to

collect in one place. The first effect of this will be to allow a bronchus, large or small, to become blocked. The air in the lung tissue beyond will then become absorbed and this area of lung will collapse. This condition is known as atelectasis. If a blockage occurs it can be cleared and a cure will follow; treatment is firstly physiotherapy with posturing, followed if necessary by aspiration of mucus through a bronchoscope. If atelectasis is neglected, infection, bronchitis and consolidation may follow. The blockage is prevented by early recovery from unconsciousness on return to the ward and then by the reinstitution of good expansion of the lung with deep breathing, particularly by expansion of the bases from contraction of the diaphragm. Education in this should have been given pre-operatively by a physiotherapist who has had special experience in this work, but with emergency cases this cannot be done. In most cases the physiotherapist can only be with the patient for a few minutes each day, but nurses are there all the time. Senior nurses should be able to know when a patient is using his diaphragm and how to encourage this movement in an unresponsive patient. General activity in bed is to be encouraged, as it does much to prevent chest complications.

In seriously ill patients, lung secretions should be moved by simple posturing. This is done by turning the patient on to one side, allowing at most 2 pillows under the head; after half an hour or so the patient can be postured on the other side. If special drainage of one or both bases is required, the foot of the bed can be raised after posturing. Breathing exercises can be carried out in this position. This posturing allows the sputum virtually to flow from the mouth, and obviates the necessity of the patient having to try to cough it vertically upwards.

Bronchitis and consolidation without atelectasis can follow operations; here again active breathing exercises and general mobility in bed in the early stages will do much to prevent the condition from developing.

Inflamed and painful arms occasionally occur. With some patients a phlebitis follows injections into the vein. This may spread for several inches along the vein which is hard, tender and sometimes red. If any solution has escaped outside the vein, there may be a red swelling and perhaps phlebitis. The treatment of both these conditions is by a kaolin poultice reapplied twice daily; a quick cure usually follows. Very occasionally a patient will complain of numbness or even weakness of the arm. This can arise from pressure on the brachial plexus whilst the patient was in the theatre. All these complications must be reported to the ward sister who will notify the anaesthetist for the case. Legal proceedings have been taken in some such cases.

Endotracheal Tubes.—These ensure a perfect air passage to the lungs. The anaesthetist (and his apparatus) can then move away from the operative field and so improve the aseptic conditions. For the same reason they give a greater margin of safety when the patient is no longer able to breathe spontaneously.

Ryle's Tube.—Though this is a matter of general nursing it is so important to an anaesthetist and his patient that reference must be made to it here. Failure to use a Ryle's tube efficiently has been a contributory cause in many deaths which followed vomiting in the anaesthetic room. The tube will permit removal of only fluid from the stomach; it cannot help with solid or semi-solid contents and for this it should be replaced by a stomach tube. It should be used in all operations on the oesophagus, stomach and duodenum, in all cases of acute abdominal surgery, and in other cases of pre-operative vomiting. Any tube that has become soft or is without marks should be destroyed, not just discarded.

Procedure.—The tube, about 6 gauge, is passed more easily if lubricated along the entire length with liquid paraffin and if the patient is sat up; it should be inserted along the floor of the nose. The patient should be instructed to make swallowing movements during which the tube is gently pushed into the nose; this is continued until the third mark is reached when the end of the tube should be at the pylorus. A nurse who has passed such a tube on herself is better able to do so on others. Gentle and repeated aspiration should follow; in the presence of intestinal obstruction this should be at 5-minute intervals so long as results are obtained. This should be continued in the anaesthetic room, and if the anaesthetist wishes, actually during the induction. Only by this intensive treatment can one control the filling of the stomach from below, if anti-peristaltic waves have commenced as a result of the obstruction. Failure to aspirate fluid does not prove the absence of fluid. The tube may yet be coiled in the mouth, and on rare occasions it can enter the trachea without causing noticeable coughing.

Intravenous Drips

More knowledge is required for efficient supervision of intravenous drips than is generally realized. Obviously there are many successful ways of overcoming the problems, but the following methods have given good results over a long period. The needle should be inserted well away from a joint, and a small splint well secured with one and a half turns of " Elastoplast " strapping at each end, is a real help to stop the vein from becoming damaged. In some hospitals where this is routine practice a splint is sent to the theatre with the patient if a drip is likely to

be needed; the surgical wards always have one available to send to the theatre when requested.

The drip can fail from causes related (i) to the needle, (ii) to the vein and (iii) to the infusion apparatus.

1. *The Needle.*—This may become dislodged from the vein; the fluid will distend the tissues and the drip run very slowly. —It should be discontinued.

The needle, especially in the elderly, may puncture the vein and still remain within the vein; in such a case the drip may run satisfactorily but the swelling in the tissues will expand.—The drip must be discontinued.

The vein wall may be lying on the bevel of the needle; in this case the drip goes slowly or stops, but if the tension at the needle point is altered the drip immediately runs faster.—If the condition is established, rotation of the needle through 90 degrees will cure the trouble.

2. *The Veins.*—These may go into spasm in surgical shock and when cold; the drip gradually slows and the veins are felt as hard cords. The flow will improve somewhat if the bottle is raised or the drip "milked"; this is done by occluding the tubing with the fingers of one hand and at a lower level driving the contents of the tubing towards the needle with the fingers of the other hand. Arms should be kept warm by appropriate covering and occasionally in a conscious patient by use of a warm bottle. Several drugs can be injected into a drip, which by relaxing spasm increase the speed of the drip. Such drugs are "Coramine," procaine, pethidine and amphetamine. The veins sometimes become compressed by tight clothing on the arm or by bandages holding splints; this slows the drip, and because the vein becomes congested blood tends to run into the needle, when clotting in the needle is likely to follow.

3. *The Infusion Apparatus.*—A clot forming on the wick of this will gradually slow the drip. The cause can usually be located by observing the effect of "milking"; there is no obstruction to the forward flow of blood but the drip chamber will be slow to refill and the drip will not run freely. When this happens the giving set should be changed.

Trouble frequently occurs when air is allowed into the apparatus while bottles are being changed. One successful way of changing bottles is as follows: Ensure that the drip is running fast prior to the change; clamp the rubber tubing as high as possible with forceps; remove the cork and insert into the new bottle; raising it high, tip the bottle sideways to pour the fluid down the rubber tubing while keeping the air inlet tube uppermost; at the same time remove the forceps. The drip should now run fast and the bottle can be hung on the stand. With

practice this procedure can be performed without mess, but if the bottle is suddenly inverted fluid is sure to drop down both glass tubes and so reach the floor; this is more certain if the drip is set to run slowly.

If a drip is to run continuously at a slow rate, it is helpful to ensure, say hourly, that it can be accelerated. The quickest way to do this is to raise the bottle; then when it has been replaced on the stand the original speed will be continued.

Anaesthetic Eye

This condition is seldom seen today. It can occur when anything comes in contact with the cornea, especially irritants, e.g. ether or chloroform. Likely causes today are sheets or receptacles touching the eye of an unconscious person or from the cornea becoming dry if an eye remains open for too long. Early treatment is a drop of Oleum ricini in each eye.

Conclusion

Many of the points that have been discussed are applicable not only to anaesthetized patients but to anyone who is unconscious from any cause whatever. Any nurse who considers that some of the less familiar points are of no interest to her should realize that she may be called to show in a coroner's or civil court that she has exercised due and reasonable care on a particular patient. Nurses, like doctors, have serious responsibilities, and today more than ever should be able not only to justify their treatment but to be satisfied that the best possible has been done in every instance.

CHAPTER 6

FEEDING OF INFANTS AND CHILDREN

BREAST FEEDING. ADVANTAGES OF BREAST FEEDING TO THE INFANT. ADVANTAGES TO THE MOTHER. ROUTINE OF BREAST FEEDING. TIME ALLOWED FOR THE BREAST FEED. CARE OF THE BREASTS. INCREASING THE SUPPLY OF BREAST MILK. TEST WEIGHING. COMPLEMENTARY FEEDING. CONTRA-INDICATIONS TO LACTATION ON PART OF MOTHER. CONTRA-INDICATIONS ON PART OF INFANT. CAUSES OF FAILURE IN LACTATION. DIET OF THE NURSING MOTHER. ARTIFICIAL FEEDING. COW'S MILK AND HUMAN MILK COMPARED. MODIFICATION OF COW'S MILK. USE OF DRIED MILK. EVAPORATED MILK. SWEETENED CONDENSED MILK. VITAMIN SUPPLEMENTS. TECHNIQUE OF ARTIFICIAL FEEDING. MAKING UP THE FEEDS. CARE OF BOTTLES AND TEATS. GIVING THE FEED. WEANING AND MIXED FEEDING. DIETARY FOR THE CHILD. DIET IN THE SECOND YEAR. DIETS FOR OLDER CHILDREN. FEATURES OF HEALTHY, WELL-NOURISHED CHILDREN. TABLE OF RECOMMENDED DIETARY ALLOWANCES.

In the past few years many investigations have been carried out and statistics collected with reference to the feeding of infants. In the light of our present information breast feeding is acknowledged to have priority claims over artificial feeding of infants.

Breast Feeding

The National Association of Maternity and Child Welfare has published a report stressing the importance of breast feeding of infants. Among other things this Report states: "Breast milk is the perfect food for a young baby because it is the safest food; it is sterile and the temperature is correct for the baby. It contains protein, fat and carbohydrate in the correct ratio; it contains antibodies to protect the infant against infection."

Advantages of Breast Feeding to the Infant.—The main advantages of breast feeding are that infant mortality is lowered during the first year; gastro-intestinal and respiratory infections are also less frequent. Anaemia due to lack of iron is less

common and digestive disturbances are reduced. Deficiency diseases, rickets and scurvy are less likely to occur.

Advantages to the Mother.—The physical association of mother and child is more intimate ; this in turn will lead to a sounder psychological background. There are no bottles and teats to buy and keep clean and no feeds to prepare each day.

Routine of Breast Feeding.—Most infants sleep for the first 6 to 8 hours after birth, during which time they recover from the strain associated with delivery. After this a regular routine is introduced and the infant is put to the breast every 3 or 4 hours, determined by his weight and sucking ability. An infant weighing less than 7 pounds is better fed 3-hourly, the routine changing to 4-hourly feeding as his weight increases. When the infant's weight is 7 pounds and over, 4-hourly feeding should be established from the start.

Three-hourly interval feeds can be given at convenient times; usually they are given at 6 a.m., 9 a.m., 12 noon, 3 p.m., 6 p.m. and 10 p.m. Four-hourly interval feeds can be given at 6 a.m., 10 a.m., 2 p.m., 6 p.m. and 10 p.m. Each infant must be treated individually ; it may be necessary to give some infants a feed when they awaken during the night. It may also be necessary to give 1 or 2 ozs. of boiled water from a bottle or by spoon until lactation is established.

Time allowed for the Breast Feed.—For the first 2 days the infant should be put to alternate breasts for 3 to 4 minutes at 3 or 4 hourly intervals, the time being gradually increased each day. Most infants will take the largest amount of their feed in the first 7 minutes. The flow of milk can be controlled by maintaining a firm pressure on the breast with the thumb and first two fingers, this will also allow a passage to be made which will help in the infant's respiratory activities. The right breast should be given first at one feed and the left breast first at the next feed. The infant should empty each breast completely. If he does not do so the milk should be expressed by hand, leaving the breasts completely empty.

Infants swallow a certain amount of air during feeding and this swallowed air will cause pain and discomfort unless it is expelled from the stomach. The mother should be taught how to assist her baby to bring up its wind ; she should remove the baby gently from the breast and support him in an upright position over her shoulder, rubbing his back gently and firmly from the bottom upwards with a steady movement of the palm of the hand. When this is carried out with success the baby will sleep peacefully after his feeds.

Care of the Breasts.—The breasts and folds beneath them should be washed with soap and water night and morning and

dried carefully. The nipples and surrounding skin should be washed and dried before and after each feed ; this is important for the prevention of blocked ducts and infected nipples. The breasts should be supported by a well fitting brassiere.

Increasing the Supply of Breast Milk.—When there is a shortage of mother's milk, the following routine should be adopted. The breasts must be completely emptied in order to stimulate the secretion of more milk. Rest is a contributory factor; the mother should remain on a bed or couch in a recumbent position for at least an hour during the afternoon. A glass of water or milk should be taken before each breast feed. Alternate hot and cold sponging of the breasts should be carried out half way between two feeds, once or twice during the 24 hours.

Test Weighing.—An average baby weighing 7 lbs. will require 2½ ozs. of breast milk per pound body weight. If there is any doubt about the amount of milk the baby is getting at each feed, test weighing is to be recommended. The baby is weighed fully clothed before he is fed and weighed again in the same clothing after he has been fed ; the difference in the two weights is the amount of milk taken. To obtain an accurate estimate the baby should be weighed at all feeds for 24 hours.

Complementary Feeding.—It may be necessary to give complementary feeds to some infants ; a dried humanized milk powder or a mixture of boiled cow's milk (1 part to 2 parts of boiled water with a small quantity of sugar added) is satisfactory for this purpose. Complementary feeds should be regarded as a temporary means of supplying a sufficient number of calories until full lactation is established.

Contra-indications to Lactation on part of Mother.—The 3 main contra-indications to breast feeding so far as the mother is concerned are as follows.

1. Active tuberculosis or a severe acute illness.
2. A prolonged debilitating disease such as diabetes, nephritis, a serious form of anaemia, heart failure, eclampsia and puerperal mania.
3. Pregnancy after the 4th month.

Contra-indications on part of Infant.—There are 2 conditions of the infant in which breast feeding should not be allowed.

1. Congenital malformation of the heart.
2. Harelip and cleft palate.

Causes of Failure in Lactation.—The causes of failure in lactation are as stated below.

1. Encroachment of business and social duties.
2. Lack of confidence and determination on the part of the mother.
3. Damage or malformation of the nipples.

4. Engorgement of the breasts and increased pressure internally, resulting in blocked ducts.

Diet of the Nursing Mother.—For the maintenance of health and successful lactation the mother will require her full share of the protective foods, plus the extra milk allowed for herself and baby. Her protein requirement is higher during lactation ; she should therefore have some meat, fish or cheese at least once each day and she should consume her full ration of fat. Fresh vegetables, salads and fruit should be included in the daily diet.

Vitamin Supplements.—It may be difficult to obtain the full recommended allowance of vitamin C from dietary sources. Concentrated orange juice, rose hip syrup or black currant syrup should therefore be taken daily. Vitamins A and D should be taken in tablets or capsules and vitamin B_1 and B_2 in yeast tablets, "Bemax" or "Marmite."

Artificial Feeding

In artificial feeding the choice of milk used will largely depend upon the individual requirements of the infant and the local supply available. The kinds of milk used for feeding normal infants are cow's milk, dried milk powder, evaporated milk and condensed sweetened milk.

Cow's Milk and Human Milk Compared.—The differences between cow's milk and human milk are shown below.

	Fat	*Sugar*	*Casein*	*Lact-albumin*	*Total Protein*	*Calories per oz.*
Cow's Milk .	3·5%	5%	3%	0·5%	3·5%	20–25
Human Milk	3·5%	6%	1%	1%	2%	20

The fat in human milk is in finer emulsion and the fatty acid ratio is not the same as that of cow's milk. The protein of human milk has a different amino acid pattern and in addition the casein-lactalbumin ratio is different to that of cow's milk. The lactose (or sugar) is slightly higher in human milk than it is in cow's milk.

Modification of Cow's Milk.—It is physically impossible to make cow's milk resemble human milk in all respects ; the best one can do is to modify cow's milk to human milk standards. This can be achieved by dilution with boiled water and the addition of sugar ; the addition of cream is unnecessary as all infants should be given daily doses of cod-liver oil which will make up

for any fat deficiency. Suitable dilutions of cow's milk, with the addition of sugar, should be given, allowing 50 calories per pound body weight for an infant weighing 7 to 10 lbs. The milk in the mixture is increased gradually, and as the infant's weight increases, his calorie requirements per pound body weight will be less. Thus an infant weighing 10 lbs. will require 45 calories per pound body weight and at 14 lbs. will only require 40 calories per pound body weight. The following examples will serve to illustrate this point. An infant weighing 7 lbs. will require 50 calories multiplied by 7; this will equal 350 calories when interpreted into a milk mixture, which should in this case consist of 11½ ozs. of boiled milk, 6 ozs. of boiled water and 1 oz. of sugar. The mixture should be divided into 5 feeds of 3½ ozs. each or 6 feeds of 3 ozs. each in the 24 hours. The milk should be gradually increased, and by the time the infant weighs 10 lbs. he should be having a mixture consisting of 17 ozs. of boiled milk, 8 ozs. of boiled water and 1 oz. of sugar, divided into 5 feeds, each feed consisting of 5 ozs. in the 24 hours. All milk used for infant feeding should be scalded, as this makes the casein more digestible.

Use of Dried Milk.—There are certain advantages to be gained from the use of dried milk in infant feeding. The protein is easily digested by most infants; the milk is manufactured under sterile conditions and packed into sterile containers; the risk of contamination is less than it is for liquid milk in conditions in which living conditions are not ideal; it is easy to carry when travelling. There are many brands and modifications of dried milk available for infant feeding. The most widely used are full cream, half cream and humanized dried milk.

The following is the composition of National Dried Milk, given in weight per ounce of dry powder.

	Protein	*Fat*	*Carbo-hydrate*	*Calcium*	*Calories*
Full cream .	7·3 gms. or (25·6%)	7·6 gms. or (26·6%)	10·1 gms. or (36·4%)	250 mgms.	138
Half Cream .	8·6 gms. or (30·1%)	4·7 gms. or (16·5%)	11·8 gms. or (41·3%)	300 mgms.	124

Lactose is not added to National Dried Milk but vitamin D is added to supply 280 international units per ounce of powder.

Full Cream Milk.—In the reconstruction of full cream milk it

should be kept in mind that 1 level measure or 1 heaped teaspoonful of powder in 1 oz. of water is equivalent to whole cow's milk. Using the liquid milk formula the 7-pound infant will require 5 feeds each containing 2¼ level measures of full cream dried milk powder in 3½ ozs. of boiled water, with the addition of 1½ level measures of sugar. The 10-pound infant will require 5 feeds, each containing 3½ level measures of full cream powder in 5 ozs. of boiled water adding from 1 to 1½ level measures of sugar.

Humanized Dried Milk.—Humanized dried milk is manufactured by separation of the basic constituents of cow's milk into their component groups ; these are then reassembled into different proportions with the addition of lactose in order to bring the mixture in line with human milk standards. The amount of humanized milk required by an infant is the same as that of human milk. One level measure in 1 oz. of boiled water is equivalent to 1 oz. of human milk ; the infant will thus require 2½ ozs. of this mixture per pound body weight.

Evaporated Milk.—This is entirely suitable for infant feeding. It is prepared by bringing whole cow's milk to boiling point and cooling to 135° F. for evaporation. The evaporated milk is homogenized to emulsify the fat globules ; by this process the fat is evenly distributed throughout the milk. The formula for infant feeding depends upon the degree of evaporation ; one brand may be reconstituted to whole cow's milk by adding 20 ozs. of water to 10 ozs. of milk, another brand may be reconstituted by adding 25 ozs. of water to 15 ozs. of milk.

Sweetened Condensed Milk.—Sweetened condensed milk has a high carbohydrate and low protein content ; its use in infant feeding should be regarded as an emergency measure only and should not be continued for longer than is absolutely necessary.

Vitamin Supplements.—These should not be added to the bottle feed ; they should be given separately from a spoon. Every infant should be given cod-liver oil 1 drachm, or halibut-liver oil 5 to 10 drops daily and black currant *purée* or rose hip syrup or concentrated orange juice 1 to 2 teaspoonfuls daily, suitably diluted.

Technique of Artificial Feeding.—In many children's homes and hospitals a special department is assigned for the preparation of artificial human milk according to formulae. The equipment here generally consists of an electrical washing machine for bottles, autoclave sterilizer, cream separator, refrigerators, hot and cold water supply, washing-up sinks, apparatus for supplying freshly boiled water, milk sterilizer and double saucepans. The smaller equipment required consists of

feeding bottles, crates in which to stand the bottles, glass and china measures, thermometer, graduated mixing bowls, teats and valves, whisks, strainers, spoons, funnels, sterile sheets, towels, gowns and masks.

When a nursery is planned for the care of a number of young children, whenever possible a special room should be set apart and equipped for the preparation of all milk feeds. If the choice of a room is possible the following points should be considered. The room should be light and well ventilated and the walls should be tiled or varnished to facilitate cleaning. The floor should be tiled or covered with a washable material. It is an advantage to have a hot and cold water supply and a sink in which to wash bottles. A refrigerator is necessary and an enamel top table is very suitable on which to prepare feeds. Fish kettles are convenient utensils in which to sterilize bottles and small equipment. The room should also contain cooking apparatus, milk sterilizer, double saucepans and store cupboards. All windows should be fitted with fine mesh wire screens to prevent flies and dust from gaining access.

Making up the Feeds.—It will largely depend upon existing circumstances whether feeds are going to be made up for the 24 hours or as single feeds. When the former method is to be employed a Soxhlet apparatus consisting of a container with a fitted bottle stand, which is placed inside the container with the number of feeding bottles required, can be used. When a Soxhlet apparatus is not obtainable a saucepan with an upturned plate at the bottom can be substituted. All cow's milk should be brought to boiling point and boiled water used for diluting the milk. It is seldom necessary to use any other kind of sugar than the ordinary granulated type. All measures, spoons, feeding bottles and bottle brushes should be boiled and kept covered until required. When dried milk is to be used for making up feeds for 24 hours it should be remembered that there is a water

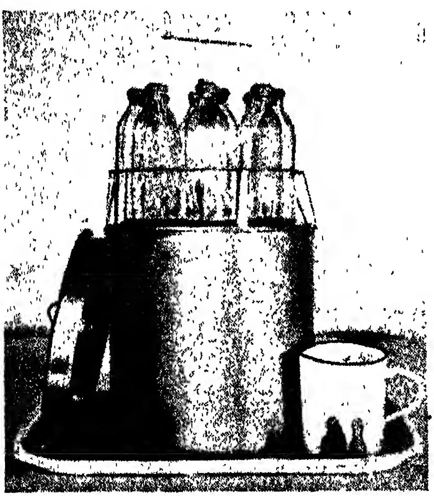


FIG. 53.—SOXHLET APPARATUS.

displacement of 2 ozs. to every 5 ozs. of dried milk powder ; to overcome this the amount of dried milk required is placed in a graduated mixing bowl or a graduated measure. Boiled water should be added gradually with continual whisking until the required measurement is reached and the powder is in solution.

It is recommended that all prepared feeds should be cooled quickly and kept at 40° F. until required ; reheating of a feed should be carried out by placing the bottle containing the feed in hot water.

Feeding bottles are of two types : 1. the Soxhlet type, which is an upright bottle ; and 2. the boat-shaped bottle ; the latter is to be recommended for use in feeding sick and premature infants and others for whom the least exertion is desired because the feed can be withdrawn through the teat quickly and easily. The Soxhlet bottle also has its uses; for example a valve is not required and most bottle washing machines are constructed for washing upright bottles.

Care of Bottles and Teats.—Feeding bottles should be rinsed out with cold water immediately after use ; they should then be thoroughly cleansed with a stiff bottle brush in hot water containing ordinary washing soda and should then be boiled. After boiling, the bottles should be immersed in sterile water until required.

Rubber teats and valves should be removed from the feeding bottles immediately after use and cleansed under running water and then boiled. Each day they should be cleansed inside and outside by rubbing with salt or bicarbonate of soda to remove all traces of fat and mucus. Teats and valves last longer when kept dry in a sterile container. Holes should be made in teats by piercing the tip with a red hot needle with the eye fitted into a cork ; the hole should be large enough to allow the feed to drip from the teat at the rate of 1 drop in 2 seconds or 30 drops per minute.

Teats are obtainable in several designs ; the choice of the teat will depend upon the capabilities of the infant. The modern teat is made with a rubber protrusion on one side which can be gripped when fixing the teat on to a feeding bottle ; this avoids contamination of the portion to be used by the infant.

Giving the Feed.—The temperature of the feed should be taken with a thermometer. It should not be higher than 100° F. When a thermometer is not available the temperature may be tested by allowing some of the feed to drip upon the anterior surface of the nurse's forearm ; if it is comfortably warm but not hot, this will be a correct index of the suitability of the temperature.

The position of the infant for feeding is important; he should

not be fed lying flat. The nurse should be seated comfortably with the infant supported in a semi-recumbent position in her arms. The feeding bottles should be held in such a manner to allow the infant to take the contents without sucking air from the bottle. The teat may require to be removed during the process of feeding to allow air to enter the feeding bottle. An infant should take all its feed in from 10 to 15 minutes. Air swallowed by the infant should be expelled from its stomach at the end of its feed ; the nurse should assist the infant to do this by sitting it up with a forward tilt and gently but firmly rubbing its back with slow rotatory movements of the hand, or by holding it in an upright position over the shoulder, as already stated on p. 169.

Weaning and Mixed Feeding

Weaning is a process of introducing into the infant's diet foods other than the food to which it has been accustomed since birth ; this can be begun at the age of 4 months. To commence weaning, a starch-containing food such as " Benger's Food," Groats or " Farex " should be given by spoon before the 10 a.m. breast feed or bottle feed, and later before the 6 p.m. feed. The amount given by spoon should not exceed 5 ozs. at first. When the child reaches the age of 5 months freshly cooked sieved vegetables or tinned homogenized vegetables may be given, to begin with one teaspoonful should be given before the 2 p.m. feed, the amount being gradually increased by a teaspoonful at a time. At 6 months of age, a broth made from vegetable stock, to which soya flour, " Marmite " and grated cheese has been added, is a suitable addition to the sieved or homogenized vegetables and may entirely replace the 2 p.m. feed; at 7 months of age semolina, egg custard and sieved fruit may be added to this meal. At 8 months of age more variety may be introduced into the diet by the addition of mashed steamed white fish, minced liver or chicken ; by now the 10 a.m. and 6 p.m. feeds should have been entirely replaced by a milk and cereal mixture given by spoon. At the age of 9 months mixed feeding should be completely established and the infant should be having 3 meals a day—at breakfast time, midday and late afternoon (tea-supper). Vitamin supplements should be given daily ; fruit juices should be suitably diluted with water and sweetened if necessary with sugar.

Dietary for the Child

Diet in the Second Year.—The diet of the toddler should now include milk, cheese, eggs, bacon, meat and fat. The following suggestions are made with regard to the planning of a suitable daily menu.

On Waking.—A drink of concentrated orange juice or rose hip syrup diluted.

Breakfast (8 a.m.).—Whole grain cereal consisting of oatmeal porridge or wheat flakes. Milk ⅓ pint. Half an egg, fresh or dried or half a rasher of crisp bacon, or mashed fish, fresh or tinned.

Dinner (12 noon).—Minced meat, liver or kidney. Steamed mashed fish. Vegetable broth containing grated cheese, soya flour and "Marmite." Freshly cooked green leaf and root vegetables finely chopped and mashed. Cereal pudding or trifle made with milk, junket or baked egg custard. Sieved stewed fruit. Water to drink.

Tea (4·30 p.m.).—Toast and butter, bread spread with butter, dripping or peanut butter. Honey, treacle or seedless jam. Sandwiches filled with grated cheese, tomato or "Marmite." A milk beverage ⅓ pint.

Note.—Cod-liver oil should be given every day.

Diets for Older Children.—The calorie requirements vary with the activity, age and sex of the child. The general principles may be thus summarized : give a diet to satisfy the appetite ; give the full allowance of all rationed food and include some of the protective foods each day. Consider the child as an individual and whenever possible give food which will be enjoyed. (See also Table on p. 178.)

Features of Healthy Well-Nourished Children

The criterion of a healthy, well-nourished child should be as follows : Good development of skeletal structures, skin and teeth, good muscle tone, smooth glossy hair, record of a steady gain in growth and weight and good mental development and activity ; a bright happy outlook on life in general with good resistance to infections and a good appetite.

RECOMMENDED DIETARY ALLOWANCES: NATIONAL RESEARCH COUNCIL OF THE U.S.A.

	Carbo-hydrate	*Protein*	*Fat*	*Calories*	*Calcium*	*Iron*	*Vit. A.*	*Vit. B_1*	*Ribo-flavine*	*Nicotinic Acid*	*Vit. C.*	*Vit. D.*
	gms.	*gms.*	*gms.*		*mgms.*	*mgms.*	*I.U.*	*I.U.*	*mgms.*	*mgms.*	*mgms.*	*I.U.*
Adult Males 70 Kg.												
Sedentary				2,500				500	2·2	15		
Moderately Active		70-100		3,000	800	12	3,000	600	2·7	18	75	
Active				3,500								
Very Active				4,500				770	3·3	23		
Adult Females.												
Sedentary				2,100				400	1·8	12		
Moderately Active		60–90		2,500	800	12	3,000	500	2·2	15	70	
Active				3,000				600	2·7	18		
Pregnancy (latter half)		85		2,500	1,500	15	3,500	600	2·5	18	100	400–800
Lactation		100		3,000	2,000	15	5,000	770	3·0	23	150	400–800
Children.												
Under 1 year.	60%	3–4*	25%	100*	1,000	6	1,500	130	0·6	4	30	400–800
1–3 years.		50		1,200	1,000	7	2,000	200	0·9	6	35	
4–6 years.		60		1,600	1,000	8	2,000	270	1·2	8	50	
7–9 years.		70		2,000	1,000	10	2,500	330	1·5	10	60	
10–12 years		80		2,500	1,000	12	2,700	400	1·8	12	75	
Adolescents.												
Boy 13–15 years.		100		3,200	1,400	15	3,000	630	2·4	16	90	
16–20 years.		120		3,800	1,400	15	3,500	770	3·0	20	100	
Adolescents.												
Girls 13–15 years.		100		2,800	1,300	15	3,000	470	2·0	14	80	
16–20 years.		100		2,500	1,000	15	3,000	400	1·8	12	80	

* Per Kilogram Body Weight.

CHAPTER 7

DIET IN DISEASE

GENERAL RULES. PRIORITY ALLOWANCES. DIET IN SPECIAL DISEASES. DEFICIENCY DISEASES. DIET IN TYPHOID FEVER. NUTRITIONAL HYPOCHROMIC ANAEMIA. PERNICIOUS AND MACROCYTIC ANAEMIA. DYSPEPSIA. PEPTIC ULCER. GASTROSTOMY DIET. INFECTIVE HEPATITIS OR CATARRHAL JAUNDICE. ACUTE CHOLECYSTITIS. CHOLELITHIASIS. REDUCING DIET. NEPHRITIS. DIABETES MELLITUS. DIET IN ACUTE CARDIAC FAILURE. DIET FOR THE TREATMENT OF GOUT.

In grave disease the physician generally prescribes the diet for the patient ; in this he is guided by the result of clinical investigation ; he ascertains also the likes and dislikes of the patient and his idiosyncrasies with regard to any particular article of diet.

General Rules.—In minor disorders, however, the organizing of patient's diet is often left to the nurse, who may be trusted to use her discretion, and the following observations may be helpful. First the patient's appetite is not always a guide to his nutritional requirements ; often appetite is not present in the early stages of an illness. Secondly easily assimilated food should be given in the form of milk beverages, egg flip, jellies, fruit drinks sweetened as desired and soups and broths containing meat and vegetable extracts. Gradually suitable dishes containing meat, fish, cheese and fat should be added. Carbohydrate can be included in the diet as sugar and as starch as contained in any of the breakfast cereals and wheat products. Fresh fruit and vegetables should also occupy a place in the daily menu.

Priority Allowances.—During periods of rationing, priority allowances of milk, eggs, cheese, meat and fat are granted to invalids and sick persons for whom a medical certificate is issued by the physician in charge of any particular patient.

Diet in Special Diseases

Deficiency Diseases.—Deficiency diseases are associated with a deficiency of certain food factors in the diet. The diseases are cured by giving the specific factors in sufficient quantities.

Rickets.—The physician usually orders large doses of vitamin D until the calcium and phosphorus ratio in the blood plasma reaches normal levels and the x-ray films show evidence of improved bone condition. The dose of vitamin D is gradually reduced until the protective dose is reached, this being given daily in the form prescribed. The diet should contain the protective foods to include as much dairy produce as possible and a daily helping of fresh fruit and vegetables.

Scurvy.—The specific treatment lies in the administration of ascorbic acid. Infants may require from 100 to 150 milligrammes daily; adults may require from 500 to 700 milligrammes daily until the symptoms of the disease respond to treatment; a daily protective dose should be given afterwards. The diet should contain plenty of fresh fruit and green leaf vegetables in addition to the basic rations of other foods.

Vitamin B Deficiency Diseases.—Diseases associated with deficient supply of vitamin B_1 and B_2 complex are often preceded by insidious symptoms before clinical evidence of beri-beri, pellagra and cheilosis develop. The diet for any of the above suspected conditions should contain all the foods which are known to be rich sources of the B_1 and B_2 group of vitamins. Milk, cheese, eggs, bacon, meat, liver, yeast, wholemeal bread and green vegetables should all be included. The physician will probably order doses of concentrated preparations of vitamins B_1 and B_2 to be given by intravenous injection or by mouth; these doses are additional to the vitamins provided ordinarily in the diet.

Diet in Typhoid Fever.—In all types of infection resulting in continued fever, there is a corresponding increase in metabolism and in the breakdown of body protein which must be replaced from dietary sources. Therefore the diet should contain more protein than is normally required by the body in health. Carbohydrate is also required in larger amounts to act as a protein sparer and to replace and maintain the store of glycogen in the muscles and liver. Fat is required to supply the essential fatty acids and the fat-soluble vitamins. The diet should contain two pints of milk daily which may be used in the preparation of beverages, junket, custards and light creams. Carbohydrate-containing foods such as "Benger's Food" "Savory & Moore's Food," "Allenbury's Food," and "Farex" when made with milk are especially suitable owing to the ease with which they are digested. Fruit juices, sweetened with glucose or sugar, supply fluid and carbohydrate in a palatable form. Boiled sweets and chocolate may also be added when the patient likes them. It is usual to give from 50 to 100 milligrammes of ascorbic acid daily during the acute stage of fever; as the patient's condition imprives, lightly cooked eggs, finely minced chicken and pounded white fish, with sieved vegatables, may be added to the diet.

Nutritional Hypochromic Anaemia.—This disease usually occurs when the patient's diet has not provided a sufficiency of iron for the requirements of the body. It can also be associated with protein deficiency, especially after a prolonged illness. Dietary treatment alone takes too long to supply the quantity of iron required, and the physician usually orders medicinal doses of iron salts in addition to a diet with a high iron content. In severe forms of nutritional anaemia gastric disturbances may be present and when this is the case the diet should consist of easily digested food selected from the following : milk, dried or fresh ; cream cheese ; steamed white fish ; corn flakes ; thin toast ; bread and butter ; lightly cooked eggs ; sponge cake ; jellies and any of the proprietary food preparations. As the patient's general condition improves, his appetite returns and his diet should be gradually increased to include " Bemax," minced meat and liver, bacon and ham, corned beef, fresh and dried fruits, oatmeal and fresh green and root vegetables.

Pernicious and Macrocytic Anaemia.—This is not entirely a disease of the blood; normally, as mentioned elsewhere in this work, the stomach secretes an enzyme known as the haemopoietic factor essential for the proper formation of red blood cells. Patients with pernicious anaemia are not able to secrete the haemopoietic factor in sufficient quantities and this leads to a pathological condition of the red cells which do not survive in sufficient numbers to maintain the normal red blood cell level. It was discovered that hog stomach and liver contained the haemopoietic factor; extracts of these when given in regular doses either orally or parenterally produced good results and the patient's red blood cells began to increase. A more recent discovery is folic acid which when given to patients with pernicious anaemia produces prompt results.

Dietary treatment will depend upon the condition of the patient ; he may be too ill to take anything but predigested foods. As his condition improves and his appetite returns the diet should be gradually increased to the level of the diet prescribed for the treatment of nutritional anaemia.

Dyspepsia.—These remarks apply also to gastritis. Before any attempt is made to prescribe any form of dietary treatment the patient's symptoms should be fully investigated and when possible the cause discovered and treated. During an acute attack of dyspepsia the patient should be given citrated or peptonized milk, diluted if necessary, and sweetened orangeade or lemonade at 2-hourly intervals ; when an improvement in the patient's condition is noticed, " Benger's " and "Allenbury's Foods " can be added. Further additions may gradually be made in the form of egg custard, milk shapes, thin bread and butter,

honey or seedless jam and plain cake or biscuits. With continued improvement the following menu may be introduced.

Breakfast (8·30 a.m.).—Cup of boiled milk flavoured with weak tea; sugar if desired. Cornflakes or well cooked porridge. Lightly boiled or poached egg. Thin stale national bread and butter or crisp toast and butter. Honey, golden syrup or strained marmalade.

Lunch (11 a.m.).—Glass of boiled milk flavoured with "Ovaltine" or "Bournvita," "Benger's" or other milk foods. Sponge cake or plain biscuits.

Dinner (1 p.m.).—Steamed white fish, chicken, rabbit or tripe; serve with a plain white sauce. Sieved cauliflower, carrots or peas. Strained tomato juice. Milk pudding, custard, junket, blancmange, jelly or steamed plain sponge pudding. Sieved fruit.

Tea (4 p.m.).—Cup of milk flavoured with tea and sugar. Thin stale bread and butter or crisp toast and butter. Honey, golden syrup or jelly, seedless jam. Plain cake or biscuits.

Supper (7 p.m.).—Grated cheese or cream cheese, steamed fish or lightly cooked egg. Thin bread and butter or crisp toast buttered. Baked egg custard or milk pudding.

Bedtime.—Glass of boiled milk and plain biscuits.

Between Meals.—Twice during the day the strained juice of an orange. Water as desired.

Unsuitable Foods.—The following foods are unsuitable and should be avoided: alcoholic drinks and mineral waters; strong tea and coffee; pickles, spiced sauces and condiments; dried fruits unless sieved, raw unripe fruit, pineapple and nuts; highly seasoned meats, rissoles, sausages, bacon and pork; raw vegetables and salads, onions and mushrooms; kippers, bloaters, herring, mackerel, salmon and sardines; suet puddings, pastry, new bread and scones; fried foods, rich meat soups and broths; wholemeal bread, oatmeal cakes and biscuits.

Instructions for a Patient with Dyspepsia.—Regular meal habits should be formed; meals should be taken at regular times each day and they should be similar in size from day to day. Meals should not be eaten quickly; food should be chewed carefully; dental treatment may be necessary. Allow a short interval of rest before and after a meal. Try to cultivate and maintain serenity in all things; irritability and bad temper are antagonistic to good digestion. Drink plenty of water between meals and avoid constipation.

Peptic Ulcer.—Peptic ulcer or gastric ulcer may occur at the pylorus, duodenum, jejunum, lesser curvature or sometimes at the greater curvature of the stomach. The condition may receive surgical treatment or it may be cured by complete rest, dieting and the administration of alkaline mixtures. Dietary treatment consists in planning a bland diet to be given at

2-hourly intervals. Ascorbic acid, from 75 to 100 milligrammes should be given daily.

First Stage.—The following is a bland diet suitable for the first stage of dietary treatment.

On Waking.—5 ozs. boiled milk.

Breakfast (8 a.m.).—5 ozs. boiled milk flavoured with weak tea. Teacup of sieved oatmeal porridge or Groats. Two breakfast biscuits or crisp toast and butter. Lightly cooked egg on alternate mornings.

At 10 a.m.—5 ozs. of a proprietary food to include 5 ozs. milk. 1 breakfast biscuit or rusk.

Dinner (12 noon).—1 tablespoonful steamed pounded fish, chicken or rabbit. 1 tablespoonful sieved potato, sieved tomato.

At 2 p.m.—5 ozs. milk made into junket, jelly or custard. 2 teaspoonfuls black currant *purée*.

Tea (4 p.m.).—5 ozs. milk flavoured with tea. Lightly cooked egg (when obtainable). 3 breakfast biscuits or rusks lightly buttered.

At 6 p.m.—5 ozs. milk made into junket or milk shape. Sieved apple, apricot or banana.

At 8 p.m.—5 ozs. milk flavoured with malted milk or "Ovaltine."

At 10 p.m.—5 ozs. milk flavoured as desired.

Notes.—Allow 1 oz. sugar daily. Honey, golden syrup, jelly or jam may be given as desired. Quantities may be increased according to the patient's progress.

Gastrostomy Diet.—This is arranged in 6 feeds of 6 ozs. each.

Constituents.—1 pint boiled milk ; 12 ozs. boiled water ; 4 ozs. full cream dried milk without added lactose ; 1 oz. sugar ; 1 teaspoonful "Marmite"; 10 drops halibut-liver oil; 90 grains of citrate of iron and ammonia.

Food value of diet : 54 grammes of protein ; 57 grammes of fat ; 98 grammes of carbohydrate. Calorie value 1,121.

To Prepare the Feeds.—Mix the dried milk with some of the boiled water, add remainder with the boiled milk, then add the sugar, "Marmite," beaten egg and other ingredients; strain before giving. It should be noted that the dried milk powder will displace 4 ozs. of fluid when mixed, therefore the total quantity will be 36 ozs. when made up.

Infective Hepatitis or Catarrhal Jaundice.—A good deal of experimental work has been carried out to assess the physiological significance of any one particular line of dietary treatment over another. It is now widely accepted that a diet with a high protein, low fat, high carbohydrate content fulfils the pathological requirements of the body. Food yeast is recommended to supply vitamin B_1 and B_2 complex. Another recently advanced theory in dietary treatment is the value of

methionine, one of the essential amino acids containing an available sulphur atom from which other amino acids can be synthesized in the body.

The quantitative requirement for protein in the diet can be met by the use of skimmed milk powder; 1 oz. of skimmed milk powder contains 10 grammes of protein. A double strength milk can be made, using 4 ozs. of skimmed milk powder to one pint of water.

The use of glucose and dextrimaltose for sweetening drinks will bring carbohydrate additional to that of the basic ration of sugar without adding too much bulk to the diet. A diet containing 80 to 100 grammes of protein, 20 grammes of fat and 400 grammes of carbohydrate is usually recommended for an adult.

Acute Cholecystitis.—The object of dietary treatment must be to rest the gallbladder. It is known that fat stimulates contraction of the gallbladder, therefore during the acute stage the diet should be planned to exclude fat. Another factor to be considered is the patient's loss of appetite ; skill and ingenuity will be required to overcome this. Fluids should be supplied to the patient in the form of sweetened fruit juices ; skimmed milk, jellies, sieved fruit and skimmed milk junket could be included in the diet. With improvement in the patient's condition, the diet should be built up gradually, skimmed milk being used for cereal puddings, beef tea, minced chicken and rabbit, pounded white fish and sieved vegetables. Rusks or dry toast served with "Marmite," jam or honey may be included. Egg yolk should not be used owing to its high fat content; the white is quite suitable when whisked stiffly and used for making meringues.

Cholelithiasis.—This condition usually receives surgical treatment, and until that event the diet usually prescribed is a fluid one, consisting of fruit juices sweetened with glucose or sugar, weak tea and meat or vegetable extracts dissolved in hot water. Milk beverages and jelly may also be added.

The postoperative diet follows the same principle for the first 48 hours. The patient's condition must be the guiding factor to the addition of semi-solid foods and to further additions until the diet is similar to the one prescribed for patients suffering from dyspepsia. With the arrival of the convalescent stage the diet may need to be readjusted. When the patient is overweight he will benefit from a diet planned to reduce weight.

Reducing Diet.—This should be planned on the lines indicated below.

Breakfast.—Tea or coffee (not coffee extract) ; milk 3 ozs. (no sugar or condensed milk) ; one egg boiled or poached or steamed white fish ; wholemeal or national bread two slices ¼ inch thick, butter ¼ oz. ; marmalade or jam ¼ oz.

At 11 a.m.—Glass of orange or tomato juice or cup of "Marmite."

Luncheon.—Average helping of lean meat, rabbit, chicken, liver or fish (steamed) ; thin gravy, green vegetables, cauliflower or runner beans ; 2 ozs. of potato ; raw or stewed fruit, jelly, junket.

Tea.—Tea with milk 2 ozs.; bread or toast, two slices ¼ inch thick; butter ¼ oz.; " Marmite " or salad.

Supper:—Tea or coffee with milk 2 ozs.; bread or toast one slice ¼ inch thick ; butter ¼ oz. Average helping steamed white fish, chicken or rabbit or one egg boiled or poached ; raw fruit or salad.

Foods to Avoid.—All fried foods ; fatty meats such as bacon, pork, sausages ; oil and salad dressings ; sugar, sweets and chocolate ; cream, cereal puddings, biscuits, pastry and cakes. Fruits tinned in syrup, thickened gravies and soups. Beer and stout.

Foods Allowed without Restriction.—Raw and cooked fruit ; green vegetables and salads ; unsweetened fruit juices ; clear soups ; meat and vegetable extracts ; saccharine (used for sweetening).

Nephritis.—There are different types and stages of this disease and dietary treatment will be ordered to meet the physiological requirements of the body as they arise in the course of the disease.

Acute Nephritis.—This occurs most commonly during or after an infection such as scarlet fever or tonsillitis. It is characterized by albuminuria and haematuria ; the duration is short and the condition seldom becomes chronic.

The principle underlying dietary treatment is rest of the kidneys as far as is possible. Fluid should be restricted to 1½ pints in the 24 hours ; this amount should include 10 ozs. milk ; the remainder of the fluid could be used as a vehicle for carbohydrate. Suitable fluids are barley water flavoured with lemon, and fruit juices diluted with water ; sugar and glucose should be added up to 6 ozs. daily to provide calories. Barley sugar and glucose fruit sweets may be given *ad lib.* With improvement in the patient's condition the diet may gradually be increased and the following may be added : fruit, jellies, custard creams, jam, honey, toast, bread and butter, sponge cake and biscuits. When progress continues, white fish, chicken, rabbit, lamb and vegetables may be included in the menu. Salt should be omitted from the cooking ; a normal diet may be resumed at the end of 6 weeks, with restriction of salt.

Chronic Nephrosis with Oedema and Albuminuria.—This condition is characterized by gross albuminuria resulting in a decrease in the plasma proteins, especially in the albumin ratio.

The diet should contain an amount of protein sufficient to replace the loss of protein in the urine and to raise the plasma

proteins; the recommended amount varies between 80 and 120 grammes. Normal amounts of carbohydrate and fat may be given in the diet. The fluid intake is restricted to 2 pints per day, and the salt content is reduced as much as possible. Vinegar and lemon juice may be used to assist in making the diet palatable. The use of cow's milk, either liquid or dried, is restricted owing to the high salt content ; 1 pint of liquid or reconstituted dried milk contains 0·6 grammes of salt. It is possible to overcome this by the use of synthetic milk as shown by McCance and Widdowson. All fat used in the above diet must be unsalted margarine or unsalted animal fat.

Ordinary bread as it comes from the baker contains added salt in varying amounts and is therefore unsuitable in a salt-restricted diet. Bread should be specially made, salt being omitted and yeast being used as the raising agent and not baking powder, which contains sodium. Protein from animal sources, other than milk and cheese, should be used in the diet. Eggs, meat, chicken and rabbit are quite suitable to give. Vitamin supplements should also be given.

Nephrosis with Hypertension and Nitrogen Retention (*Azotaemia Nephritis*).—This is a type of chronic nephritis which has become progressively worse. When the blood urea is raised with a corresponding rise in blood pressure the patient's condition is very grave, and uraemia is the terminal stage. Dietary treatment should be based on changes in the blood chemistry ; the fluid intake should be unrestricted in order to satisfy thirst. The protein intake should be adequate for the physiological requirements of the body; for an adult this will be between 65 and 70 grammes per day. The diet should contain not less than 1 pint of milk per day ; it should also contain animal protein from eggs, cheese, meat, poultry and fish. Food should be cooked without added salt. To sum up the dietary treatment for the above condition, the patient should receive the utmost sympathy and understanding compatible with good judgment. He should not be subject to any unnecessary rigidity in his diet which is likely to cause further suffering, and his likes and dislikes should be considered.

Diabetes Mellitus.—Attempts at the treatment of diabetes mellitus by dieting are more than a century old ; this consisted of removing sugar from the diet at first ; later on starchy foods were also reduced. From 1914 to 1922 the main dietary treatment consisted of low carbohydrate and moderately high fat and protein, combined with periods of starvation. The results were better than any previous dietary treatment ; life was prolonged by 25 per cent, and death from coma was reduced by 50 per cent. In 1922 insulin was introduced in the treatment and fasting and undernutrition were discontinued altogether.

The modern line of treatment consists in estimating the severity of the diabetes and prescribing insulin and a diet to suit the particular requirements of the individual patient. This is carried out by the physician.

Degrees of Severity.—The various degrees of severity occurring in diabetes are described by R. D. Lawrence and graded by him into 3 groups each characterized by the amount of endogenous insulin secreted.

1. Mild Diabetes, occurring in middle-aged and often obese subjects. In this group patients secrete sufficient insulin to maintain a normal fasting blood sugar level; they are not able to metabolize ingested carbohydrate without a rise in blood sugar and glycosuria. This group can be controlled by strict dietary measures and without the injection of insulin.

2. Diabetes of moderate severity controlled by injected insulin. In this condition patients secrete some insulin but not in sufficient quantities to maintain a normal fasting blood sugar without injected insulin.

3. Severe Diabetes, or absolute diabetes. In this group, patients are unable to secrete any endogenous insulin and depend entirely upon injected insulin for carbohydrate metabolism.

Construction of the Diet.—The calorie requirements for the individual patients, age group and activity, are usually based upon the recommended dietary allowances of the National Research Council of the U.S.A. (see page 178).

The following is the usual normal healthy individual's ratio of each class of foodstuff: carbohydrate 5; protein 1; fat 1. The diabetic patient's ratio is just half this amount so far as carbohydrate is concerned. To enable the diabetic patient to obtain sufficient protein and fat, the Ministry of Food allows the following special increase of certain rationed foods: a priority allowance of 1 pint of milk daily, 2 extra meat rations, 12 ozs. of cheese and 2 extra butter and margarine rations per week.

The diet should be arranged to include each day 1 pint of milk and some of the cheese, meat and fat ration. When the diet is arranged for the patient with mild diabetes without injected insulin, the carbohydrate is distributed evenly throughout the meals for the day. The physician will decide upon the distribution of carbohydrate for patients to whom injected insulin is given. He will be guided by the amount of glycosuria present at stated times each day.

In cases in which obesity is present an attempt should be made to reduce the patient's weight to a normal weight level.

Buffer Meals.—These are small subsidiary meals given to prevent the occurrence of hypoglycaemia. They consist of 10 to 15 grammes of carbohydrate which may be taken as a milk beverage, consisting of 5 ozs. of milk plus one teaspoonful of

"Ovaltine," or ¾ oz. of semi-sweet biscuits, or 1 oz. of chocolate. Many diabetic children require a subsidiary meal between breakfast and luncheon. Children attending school are allowed ⅓ of a pint of milk at school during the morning. Usually this is sufficient for the diabetic child, although it may be necessary to allow some children an additional 10 grammes of carbohydrate. It may be necessary to allow older children 10 grammes of carbohydrate at about 10 p.m.

The Line Ration Diet Scheme.—The Line Ration scheme planned by R. D. Lawrence is a clear well defined system, involving the minimum calculation for the diabetic patient. Food items are arranged in 2 columns, one in red type, the other in black. Each black line contains 10 grammes of carbohydrate, and each red line 7½ grammes of protein and 9 grammes of fat. The physician prescribes the ratio of black lines to red lines, and the patient decides for himself upon meal constituents or courses by selecting articles of food from the line ration sheet. Nurses are recommended to make themselves familiar with the special line ration chart.

Instruction to Diabetic Patients.—The cooperation of the patient is required for the success of dietary treatment. To obtain this the patient should be given a simple explanatory talk by his physician on the pathology of his disease, and the reasons for treatment and for weighing his diet when necessary. He should be told how to recognize symptoms of hypoglycaemia which may occur when the regular meal is delayed beyond a certain time, or when for any reason there is loss of appetite and a meal is uneaten, or after brisk exercise. He should be instructed to carry lump sugar or chocolate to eat when the symptoms arise ; one lump of sugar or one teaspoonful of granulated sugar contains 5 grammes of carbohydrate. In the event of illness, particular emphasis should be made on the importance of continuing to inject the full dose of insulin, and taking carbohydrate in the form of milk beverages or fruit juice with added sugar or glucose.

Surgical Emergency and Dietary Treatment.—The physician will prescribe glucose by mouth and an injection of insulin to be given, when possible, 3 hours before the operation. The glucose may be given in fruit juices or in weak tea without milk, whichever the patient prefers. It may also be necessary to give saline and glucose by intravenous drip during the operation. The post-operative treatment is determined by the condition of the patient. It is usual to give a solution of glucose at 3-hourly intervals until vomiting has ceased. With improvement in the patient's condition, tea and milk beverages may be given and additions made gradually until the patient can tolerate an ordinary light diet, calculated to cover his calorie requirements.

Diet in Acute Cardiac Failure.—The principle of dietary treatment is rest to the cardiovascular system. This is achieved by giving easily digested food at regular intervals ; it is known that glucose is quickly absorbed by the body and it is of especial value in the rehabilitation of the cardiac muscle. The diet should contain glucose, orangeade, fruit juices with added sugar, barley sugar, honey, jam and rose hip syrup or black currant *purée*. Other carbohydrate foods which may be given include breakfast cereals, " Benger's " and " Allenbury's Foods," toast, rusks, sweet biscuits, spongecake and sweetened sieved fruits, or grapes with pips and skins removed. When oedema is present the fluid intake should be restricted to 1½ pints of fluid per day, to include 1 pint of milk. Salt should not be added in the cooking of food or used as a condiment with food.

With improvement in the cardiovascular system the patient's appetite usually returns, and the following additions may be made to the diet : lightly cooked eggs, steamed fish, chicken, rabbit and tripe, bread and butter, grated cheese, sieved vegetables, stewed fruit and milk puddings. Vitamin supplements, ascorbic acid and " Bemax," may be given daily. The food should be lightly cooked and easily digested. The meals should not be bulky.

When obesity is present this is often a cause of continued cardiac embarrassment and a reducing diet will be a real help to relieve this condition, more so if the nurse can enlist the full cooperation of the patient.

Diet for the Treatment of Gout.—The main principle of dietary treatment is to reduce the consumption of purine-containing foods to the lowest possible level, and at the same time to plan a diet to contain sufficient amounts of all the food factors for the maintenance of health.

The following foods are considered purine-free and may be used freely : milk, butter, margarine, cheese, eggs, fruit, jam, honey and confectionery. Other foods allowed in moderate amounts are peas, beans and lentils, cereals, vegetables and salads. It is now known that tea and coffee may be given without adverse effect. Alcoholic beverages and wines should be avoided. The fluid intake should not be restricted.

CHAPTER 8

PHYSIOTHERAPY

MASSAGE. USES. MUSCLE RE-EDUCATION. REMEDIAL GYMNASTICS. BREATHING EXERCISES. TREATMENT BY LIGHT. ULTRA-VIOLET RAYS. NATURAL SUNLIGHT. ULTRA-VIOLET RADIATION BY ARTIFICIAL MEANS. ACTION ON BACTERIA. RADIATION. APPLICATION OF U.V.R. ERYTHEMA. IMPORTANT POINTS FOR THE NURSE. PHOTO-SENSITIZATION. PHYSICAL AGENTS USED IN ELECTRO-THERAPY. DIRECT CURRENT. ALTERNATING CURRENTS. CONTRA-INDICATIONS. ELECTRODIAGNOSIS.

PHYSICAL medicine is a comprehensive term, used to indicate treatments by various means. It includes 1. massage and manipulations ; 2. muscle re-education ; 3. remedial gymnastics ; 4. radiation by various forms of light ; 5. all forms of electrotherapy. Applications of mud and wax are types of heat treatment used with benefit for the stimulation of scar tissue and for other conditions.

Massage

Massage has been used for curative purposes from the earliest times. Chinese, Japanese, Greeks, Egyptians, Turks and Romans made use of it hundreds of years before the birth of Christ. About 200 years ago it was more scientifically practised by the Scandinavians, especially Swedes. It was introduced into Great Britain by the American neurologist, Weir Mitchell, who advocated its use for hysterical and neurasthenic patients.

Uses.—Massage is the scientific manipulation of the soft tissues of the body, and may have a stimulating or sedative effect according to the type used. It is useful in preventing the formation of adhesions, in removing the products of inflammation and in maintaining muscle tone. The sedative type is used to relieve pain and muscle spasm, to soothe overexcitability (as in chorea) and to induce sleep in patients with insomnia. A special kind of massage is given for rheumatic fibrositis. The various types of massage are known as effleurage, stroking, kneading, petrissage (picking up, wringing and rolling), frictions, *tapôte-*

ment (hacking, clapping, beating and pounding), vibrations and shakings.

Muscle Re-education

Muscle re-education includes the use of weightless exercises (in which gravity is eliminated and friction made negligible) and assisted, resisted and free movements. Weightless exercises may be given in a deep pool of warmed water, to which in order to increase its buoyancy, salt may be added. Alternatively there is the Guthrie Smith suspension frame, with the use of which, by means of ropes and slings, pulleys, springs and weights, any muscle group can be isolated ; then 1. assisted, 2. gravity-free, or 3. resisted movements, carefully graded from the easiest to the most difficult, may be given as the condition requires.

Remedial Gymnastics

Remedial exercises have been derived as a result of the work of Ardvedson, Ling, Klapp, Thulin, Fraenkel and many others. The best workers learn the basic principles of all these and adapt the exercises to suit individual needs. The exercises are used in treatment for, and prevention of, conditions such as scoliosis, kypho-lordosis, wryneck, knock knee, flat feet, pes cavus and hallux valgus, as well as for rehabilitation after injury, whether the latter be due to trauma or to disease. With reference to rehabilitation, later in this work the treatment of poliomyelitis (Section IX) and of scoliosis (Vol. IV, Section X) are given a good deal of attention, because so much benefit can be gained by the special remedial exercises used.

Breathing Exercises.—Breathing exercises of different types are used with great benefit for conditions such as asthma and bronchitis, in the period after chest operations (not T.B.), and in cases in which there is poor lung expansion. In bronchiectasis the exercises are combined with tipping, clapping and vibrations.

Treatment by Light

From time immemorial the rays from the sun have been used for the cure of illness. In antiquity, Egyptians, Greeks and Romans believed in the life-giving properties of the sun. In the Middle Ages, however, treatment by sunlight was discarded and it was not until 1666 that a fresh era was begun with the discovery of the visible spectrum by Sir Isaac Newton. Newton missed the discovery of ultra-violet rays only because he lacked sufficiently delicate apparatus to reveal them.

Ultra-Violet Rays.—Ultra-violet rays are found as a band beyond the violet of the visible spectrum ; certain portions of this band are of proved therapeutic value.

History.—Sunlight was first suggested as useful in the treatment of rickets in 1890. The water-cooled carbon arc lamp was first introduced by Finsen in 1893 for the cure of lupus and surgical tuberculosis. Rollier's famous clinic at Leysin in Switzerland was opened in 1903 for the treatment of tuberculosis by natural sunlight at high altitudes. In England, in the earlier part of the present century, much pioneer work with both natural and artificial sunlight was done by Gauvain at Alton and at Hayling Island.

Effects.—Notwithstanding the possibilities of establishing sun-bathing stations in Great Britain, the fact remains that in the populous and built-up areas, numbers of people, and more especially children, suffer from lack of sunlight ; it is therefore necessary to resort to artificial methods of providing sunlight. The chief sources are mercury vapour arc lamps, carbon arc lamps and the metal, tungsten.

The effects of ultra-violet light are as follows : 1. dilation of the peripheral vessels and heating of the blood vessels ; 2. lowering of the blood pressure ; 3. bactericidal action ; 4. destruction of micro-organisms ; 5. increase of the activity of the endocrine glands; 6. increase of metabolism; 7. increase of calcium in the body ; 8. splitting up of sebum into fatty acids and cholesterol which is again broken up to form a by-product of ergosterol from which vitamin D is evolved.

Conditions Treated.—The conditions which benefit from ultra-violet light are rickets, debility, alopecia, gangrene, scar tissue, erysipelas, impetigo, acne, ulcers, psoriasis, nasal catarrh, hay fever and asthma, pyorrhoea, anaemia, high blood pressure, acidosis, toxaemias of pregnancy, rheumatic conditions and lupus. The benefit obtained from irradiation in pregnancy is due to the biochemical effect on the skin, with calcium-phosphorus activation. The iodine content is also increased in rheumatic conditions.

Treatments for all these conditions have their special technique which it is impossible and undesirable to describe in this work.

Units.—The usual units of measurement are the millimicron (m.u.) and the Ångström unit (Å or A.U.)—1 millimicron equals 10 Å.

Unit.	*Symbol.*	*Millimetres.*
Ångström.	Å or A.U.	$\frac{1}{10,000,000}$
Millimicron.	mμ. or μ.m.	$\frac{1}{1,000,000}$
Micron.	μ.	$\frac{1}{1,000}$

Natural Sunlight.—Those solar radiations which reach the earth's surface lie chiefly within wave lengths of 300 to 3,000 m.μ., their maximum between 470 and 485 m.μ. At the surface of the earth, the radiations from the sun contain only 0·1 per cent. of ultra-violet rays shorter than 131 m.μ. owing to the rapid absorption of ultra-violet radiation by water vapour in the atmosphere (Brooks). After natural sunlight has been filtered by the atmosphere it is almost completely devoid of the shorter ultra-violet rays. The filtered effect is variable and depends on several factors —the amount of moisture and the thickness of the layer which the rays have to penetrate ; smoke in the atmosphere ; the position of the sun in the sky. The lower the sun, the thicker the layer and the less the ultra-violet radiation. In winter there are very few short ultra-violet waves in the sun's rays, even at midday. A smoky atmosphere filters out almost all the beneficial rays.

Ultra-Violet Radiation by Artificial Means.—To produce artificial ultra-violet rays the source must have a temperature of at least 3,000° C. ; this would melt any metal, therefore the only source that can be used at present is the electric core. Different types of lamps produce different amounts of radiation from the various regions of the electromagnetic spectrum, the radiation depending upon the temperature of the core and the metallic elements in the arc.

Mercury Vapour Lamps.—In these lamps the source of the ultra-violet light (U.V.L.) is mercury vaporized in a vacuum and at high or at low pressure. Radiation from a high pressure type of lamp is composed of about 5 per cent of those short U.V.L. rays which have a strong bactericidal action and which are completely absent in natural sunshine, 28 per cent of total ultra-violet radiation, 20 per cent. of visible light and 52 per cent of infra-red rays.

Fig. 54.—Ultra-Violet Radiation.

Low pressure mercury vapour lamps give a spectrum which is much the same, but they are kept in action by low voltage electric current.

Carbon Arc Lamps.—The radiation varies according to the type of carbon used but it has a continuous spectrum approaching that of natural sunlight, although still not an exact match. It is a very useful radiation for many conditions but it has its disadvantages, being rather dirty in use ; gases and fumes arise in the arc as the carbons and chemicals are consumed ; this can be dealt with by proper special ventilation. Another point is the time factor ; longer exposures are necessary with some carbons and the lamp is therefore sometimes unsuitable for a busy clinic.

The Tungsten Arc.—This type has also a continuous spectrum. It combines many of the features of the mercury and the carbon arcs.

Action on Bacteria.—It has been said that most bactericides do almost as much damage to the adjacent tissue cells as they do to the bacteria. Ultra-violet rays of a wave length of 2,950 Ångström units or shorter have a destructive effect on bacteria (the range of bactericidal rays lies between 2,400 Å and 3,020 Å). These rays are, however, selective in their action and at the same time have a constructive or stimulating effect on bone or tissue cells. This paradoxical action has been explained as follows. Phenylalanin and tyrosin, two of the 15 amino acids predominant in proteins making up tissue and bacteria cells, show marked absorption for ultra-violet rays. These two amino acids are found predominantly in bacteria and rarely in tissue cells, thus the ultra-violet rays are able to destroy the bacteria and stimulate the tissue cells.

Radiation.—

PERCENTAGE OF RADIATION BY VARIOUS SOURCES.

Electric Arc	*Infra-Red*	*Visible Light*	*Ultra-Violet*
Carbon . .	85%	10%	5%
Mercury . .	52%	20%	28%
Tungsten . .	68%	16%	16%

Application of U.V.R.—Laboratory experiments have shown that the time in seconds required to kill bacteria varies according to the micro-organism ; for instance gonococci and meningococci require about 6 seconds; group III pneumococci 25 seconds. The penetration of the ultra-violet rays from the water cooled lamp is slight and the rays must be conveyed to the region involved. Rods or applicators made of the purest quartz and shaped to be used to the best advantage are used to convey

ultra-violet by reflection and refraction from the burner to the area to be treated.

The dose is measured by the reaction of the patient but the action of the rays on the skin is also some guide.

Erythema.—Skin erythema following ultra-violet radiation develops after a latent period which may vary from 1 to 8 hours and must be observed. It is a skin flush accompanied by a vascular dilatation. The degrees usually distinguished are as follows.

Sub-erythema.—Here there is no visible reaction. The dose is determined as one quarter of the second degree erythema. This is a sedative dose.

First Degree.—This is a reaction so slight as to be scarcely noticeable. Reddening is faint, occurs after a latent period of some hours, usually subsides within 1 or 2 days and is not followed by visible exfoliation. This is a minimal erythema dose and may be given as a tonic course.

Second Degree.—Here there is a mild sunburn reaction. Redness is plainly visible, followed by a slight granular exfoliation which subsides in about 3 days, leaving some pigmentation. This is a stimulative dose.

Third Degree.—A reaction similar to that of severe sunburn. The reddening is intense and the epidermis can be peeled off in large strips. It takes about a week to subside, leaving pigmentation. This is essentially a local reaction, a regenerative erythema, an inflammatory stimulus and a counterirritant; on no account must it be used over a large area.

Fourth Degree.—Here there is a reddening after a short latent period (about 2 hours) and deepening until exudation and blistering result. This persists for many days and is administered only on a very small area (about the size of a threepenny piece). This is a bactericidal or sterilizing dose generally administered at contact sometimes with pressure with a Kromayer lamp; it is used in the treatment of lupus.

Important Points for the Nurse.—This short account does not claim and is not intended to be a course in artificial light therapy. A few points that may be of interest to nurses are mentioned, since they naturally like to know something about the treatments given to their patients in the physiotherapy department. Exposure to light causes a slight rise in temperature so care must be taken that the patient does not catch a chill after treatment. An extra wrap should be provided.

It is almost unnecessary to mention that during general light treatments, proper sunlight glasses (which cut out any rays which would be harmful to the eyes) must be worn by patient and operator.

Photosensitization.—It should be remembered when treatments of ultra-violet light are given that certain drugs, endocrines and metals are photosensitive. Cautious dosage is indicated when these are being used. The summary of these is given below.

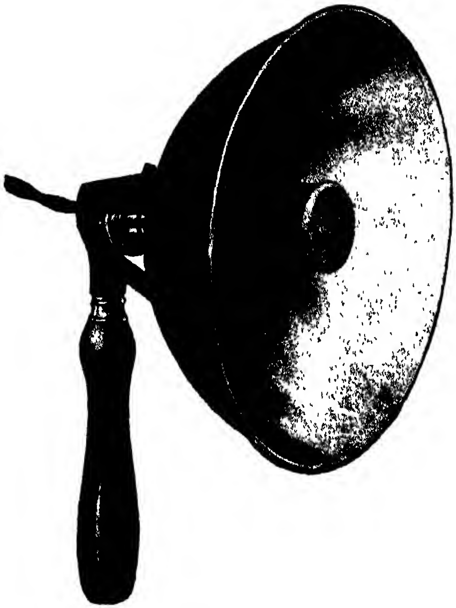


FIG. 55.—" STANCO-TROUP " HAND LAMP (INFRA-RED).

This hand lamp produces an abundance of infra-red radiation. The application of this form of treatment is successful in a large number of painful conditions.

(*By courtesy of Stanley Cox, Ltd., London.*)

Drugs.—Quinine, trypaflavine, eosine, chlorophyll, pyridine, gonacrine, methylene blue and other fluorescent or aniline dyes.

Endocrines.—Insulin, adrenalin, pituitrin, thyroid gland extract.

Metals.—Heavy metals circulating in the blood increase the effect of U.V.L. ; the effects of drug therapy in which these metals are given are also definitely increased by irradiation with actinic rays. This applies to mercury, iron, bismuth, gold, silver, and especially to calcium and its salts.

Desensitizers.—Resorcin, camphor and its derivatives. In the hands of experienced workers, irradiation with sensitizers, especially in treating sinuses, is of value.

Physical Agents used in Electrotherapy

These may be considered in 4 categories : 1. electrical currents; 2. heat ; 3. light ; 4. wave lengths in the electromagnetic field outside the visible spectrum. Electrical currents may be divided into direct (continuous, constant, galvanic), alternating and oscillating groups.

Direct Current.—Direct currents traverse the body by the

FIG. 56.—GALVANIC AND SINUSOIDAL APPARATUS.
This unit provides a constant current and an alternating current suitable for medical application.
(By courtesy of Stanley Cox, Ltd., London.)

regular ionic movement of the salts in solution in the body. During their passage through the body these currents meet with some resistance, chief of which is the skin. The current flows from positive to negative ; the positive is named the anode and the negative the cathode. Alkalis collect under the cathode and acids under the anode, either of which in concentration may cause an electric burn. High concentration should therefore be avoided. The direct current is used in ionic medication, in which various drugs are driven into the body, some of which may be vasodilators affecting the circulation by reflex action, some cleansing agents used for treating septic wounds or ulcers, and

others sedative such as the salicylic ions which are used for the relief of pain since they have an analgesic effect on superficial nerve endings. The constant current applied through a normal saline solution and without the use of drugs has a marked effect on traumatic oedema. It is supposed that by alteration of the electronic balance of the tissues, osmosis of fluids takes place from the tissue to the smaller vessels. The constant current may be used as a sedative to allay muscle spasm ; here the anode is placed on the affected area and the negative at some distant part of the body. It is maintained by many that the benefit derived from ionic medication or ionization is due to the passage of the current and not to the use of any particular drug.

Interrupted Galvanic Current.—The interrupted galvanic current is used to improve the circulation and to maintain muscle tone by stimulating contraction when no response is obtained by the faradic current and also in electrodiagnosis. It has been used with benefit for the treatment of chilblains ; here the usual method is to immerse the affected limb in a bath of warm water and to apply the degree of current necessary to cause a slight contraction of the muscles. This should be a daily treatment if possible.

Alternating Currents.—These may be of high or of low frequency. The direction of the flow may be changed from 50 to 50,000,000 times per second. The sinusoidal and the faradic are currents of low frequency; those of high frequency are oscillatory in character.

Sinusoidal Current.—The sinusoidal current is not used to any great extent. It is not very good as a muscle stimulator, since when it is used in sufficient strength to obtain a muscle contraction its effect is somewhat painful. It is, however, used with benefit for circulatory disturbances such as Raynaud's disease or when the limb is blue and cold as in poliomyelitis.

Faradic Current.—The faradic current is invaluable in the maintenance of muscle tone, for sensory nerve stimulation and for electrodiagnosis. To obtain alternate contraction and relaxation of muscle it must be interrupted, this being done sometimes by a mechanical surger, but hand surging is the method of choice; this is done by inserting a magnet in the form of a rod composed of iron filings within the primary of the faradic coil and withdrawing it with regular rhythmic movements. This current is also very useful in conditions in which there are fatigue products in the muscle. The muscle movement thus obtained causes elimination of waste products such as sarcolactic acid, without further fatigue to the patient, on account of the fact that the movement is performed for him.

High Frequency Current.—High frequency currents, oscillating in type, alter their rate of flow from 5,000 to 1,000,000 times per

second in long wave diathermy, and 50,000,000 times per second in short wave diathermy. The therapeutic effect is due to the production of heat in the tissues. The currents are of high voltage, 2,000 to 4,000 volts; the amperage is also high, and the current is conducted from one ion to another and by induced currents from cell to cell. The patient is placed in an electro-magnetic field, and the heat generated in the tissues is due to the

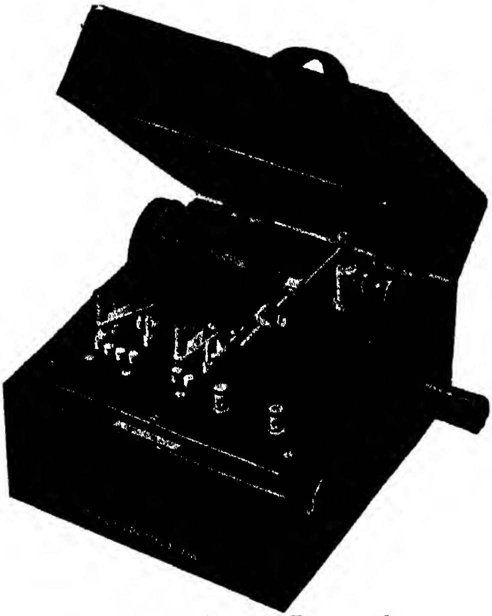


FIG. 57.—SMART-BRISTOW FARADIC COIL.
This apparatus provides an interrupted current (Faradic) which, when applied to a patient, produces considerable muscular activity with very little sensation of pain.
(By courtesy of Stanley Cox, Ltd., London.)

resistance of the tissues to the passage of the current. The most resistive tissue to ultra high frequency is fat, then bone, skin, muscle, nerve and connective tissue in that order. The effect is one of deep heat and is of great value in rheumatic and inflammatory conditions. The short wave diathermy has to a great extent superseded the long wave although in treatment of conditions such as sciatica and brachial neuritis the latter often is to be preferred. The short wave is employed with great benefit in septic conditions such as boils and carbuncles and infected wounds. Deep heat in the tissues has a bactericidal effect on

some organisms, especially the gonococcus, which have a low lethal temperature.

Contra-indications.—Advanced arteriosclerosis. Tuberculosis. These currents should not be used in cases in which gangrene is threatened because they cause congestion in places from which it cannot be drained away properly, and thus the process is speeded.

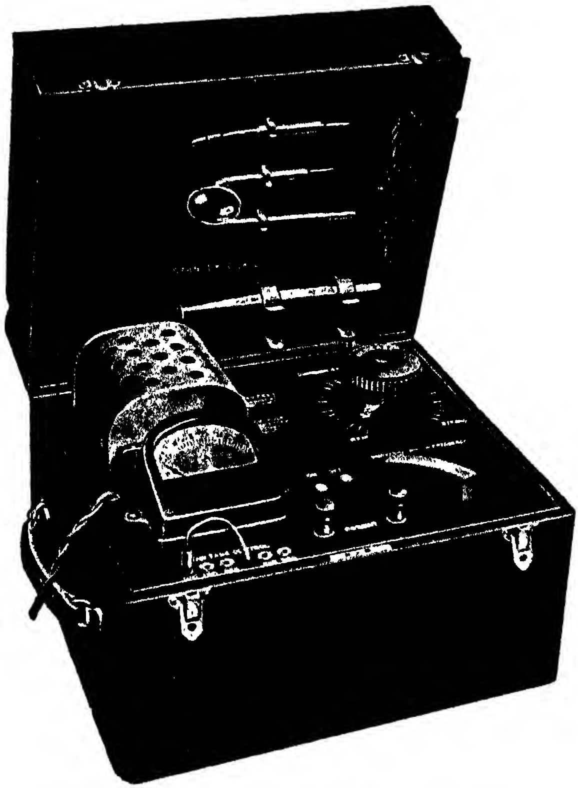


FIG. 58.—JUNIOR "INTERTHERM" DIATHERMY.
The current oscillates at a frequency of approximately 1,000 kilocycles per second.
(By courtesy of Stanley Cox, Ltd., London.)

All forms of treatment by electrotherapy should be undertaken only by those qualified in the subject.

Electrodiagnosis.—Much research is being carried out with reference to this aspect of electrotherapy. The depolarization

caused by electric disturbances in the case of neuromuscular fibres is known as the action potential. An accurate scheme of diagnosis has been evolved by the use of the electromyograph with which action potentials are by amplification conveyed to loudspeakers or to a photographic film.

The older method of testing with the faradic and galvanic current still has its uses. There is said to be a reaction of degeneration when there is no response to faradism and a sluggish response to the interrupted galvanic current.

Electrical shock therapy used in mental diseases is employed increasingly with good results. It is a form of treatment which requires great care and a special team of trained workers of experience.

SECTION IX

MEDICAL NURSING

CHAPTER 1

DISEASES OF THE BLOOD

ANAEMIAS. SYMPTOMS AND SIGNS. CLASSIFICATION. CHLOROSIS. SYMPTOMS AND SIGNS. TREATMENT. PERNICIOUS ANAEMIA. CAUSES. SYMPTOMS AND SIGNS. TREATMENT. COMPARATIVE RED CELL COUNT. APLASTIC ANAEMIA. SECONDARY ANAEMIA. CAUSES. TREATMENT. AGRANULOCYTOSIS. CAUSES. SYMPTOMS AND SIGNS. TREATMENT. POLYCYTHAEMIA. SYMPTOMS AND SIGNS. TREATMENT. OTHER BLOOD DISEASES. HAEMOPHILIA. PAROXYSMAL HAEMOGLOBINURIA. PURPURA. LEUKAEMIA. LYMPHADENOMA. SPLENIC ANAEMIA. ACHOLURIC JAUNDICE.

In the study of the diseases of the blood we have to deal with the various forms of anaemia, the general term applied to abnormalities of the blood whether they be found as affecting the red blood cell, the leucocyte or the plasma. Sundry other unclassified diseases also require to be investigated.

The organs of circulation may be diseased in different regions—heart, pericardium, large blood vessels, capillaries—or in all these parts together as a demonstration of general disease.

Anaemias

The word, anaemia, means literally "bloodlessness." This is, however, a misnomer, for the quantity of blood is seldom diminished to any great extent. Even in severe haemorrhage, after a few hours the blood volume is restored at the expense of tissue fluids. In the group of diseases known as the anaemias, the quality of the blood is altered from that of the normal. The quantity and size of the red cells may be affected; there may be abnormalities of the leucocytes or of the plasma. Whatever the source of anaemia, one fundamental effect must be understood. Blood flows to every cell of the body, taking both food and oxygen to the tissues. If the transport system is in any way impaired

we must expect that the tissues will suffer from starvation and therefore that the protoplasm will be weakened. Anaemia is not merely a disease of the blood; it is a condition with far-reaching effects, often causing great constitutional debility. Particularly does the heart become weakened owing to lack of proper nourishment and to excessive strain.

Symptoms and Signs.—The skin and mucous membranes are usually pale, although it is often difficult to estimate the degree of anaemia by merely looking at the face and lips of a person. A much more reliable indication is the appearance of the fingertips, which in a truly anaemic person lack the normal pink tinge of the healthy. A proper appreciation can be made only by means of a blood count. (See Vol. I, pp. 147, 148.)

Breathlessness and palpitation on slight exertion are due to deficient oxygen-carrying power of the red cells. The patient breathes more deeply in an effort to obtain sufficient oxygen for his needs and the heart beats more rapidly to the same end. In spite of this there may be swelling of the ankles and even generalized oedema, due to an impaired circulation as the heart becomes weakened under the strain.

There is general muscular weakness. Fainting may occur. In extreme forms of anaemia there may be mental derangement owing to cerebral anaemia. The appetite is often poor and this completes a vicious circle, for the person who will not eat cannot hope to be anything but anaemic.

Disorders of menstruation are common; there may be complete cessation of menstrual flow (amenorrhoea) or profuse menstrual flow (menorrhagia).

Classification.—Anaemias are classified as follows.

1. Primary anaemias, which include chlorosis, pernicious anaemia and aplastic anaemia.
2. Secondary anaemias.

Chlorosis

Chlorosis or " the green sickness " is now almost unknown. The Victorian young lady who spent her time in close rooms, who wore tight corsets and whose ambition was to be " pale and interesting " was usually the victim of chlorosis. As soon as woman woke up to the benefits of an open air life, the free use of her limbs, the value of direct sunlight and the real joy of living, chlorosis began to disappear. The cases which occasionally occur nowadays can nearly always be traced to certain prolonged and flagrant contraventions of the laws of health and many doctors and nurses of the present day have never seen a case of this form of anaemia.

Symptoms and Signs.—In addition to what has been said above the disease is characterized by a sickly greenish pallor of the skin from which the disease derives the name, chlorosis.

Treatment.—This consists in a complete mental and physical reorganization. A short rest in bed is sometimes necessary until the blood picture approximates the normal. Later on, exercise in the open air is most beneficial. Iron in various forms is given by mouth in large doses. The diet should be plentiful and should include the iron-containing foods, e.g. eggs, red meat, green vegetables and fresh fruit.

Pernicious Anaemia

Not long ago the diagnosis of this disease was nothing less than a death sentence. During the last 15 years great advances have been made in its understanding and treatment. It is a disease which attacks males and females during middle life and which if untreated runs a fatal course in a few months or years. It may have a hereditary basis.

Causes.—The stomach normally produces a certain factor (the intrinsic factor of Castle) which is necessary in order that the body may use certain elements in the food (extrinsic factors). Together these factors supply the haemopoietic principle (blood-forming principle). This is stored chiefly in the liver, is carried by the blood stream and is responsible for the correct formation of red blood cells in the bone marrow. In pernicious anaemia the stomach fails to produce the intrinsic factor and therefore the haemopoietic factor is absent or deficient. A great many of the red cells in the bone marrow fail to mature and are present in the blood circulation as giant cells (megalocytes). These cells carry more haemoglobin than in normal circumstances, but on account of the fact that their number is diminished the total amount of haemoglobin is also lessened. Pernicious anaemia is therefore described as macrocytic (i.e. large-celled) and hyperchromic (i.e. each cell has more than its complement of haemoglobin). (See also p. 207.)

Symptoms and Signs.—In addition to those typical of anaemia in general, the following are especially associated with pernicious anaemia.

The patient's skin is pale lemon yellow in colour, due to presence of bile pigments from excessive destruction of red blood cells. There is tingling in the fingers and toes ("pins and needles") with gradual loss of sensation and power. Actual progressive paralysis may occur; this is due to a subacute degeneration of the spinal cord which when established is very difficult to treat efficiently.

Appetite and digestion are impaired. Nausea and vomiting are common. The tongue is typically white and shiny and devoid of fur. There is sometimes abdominal pain of an indeterminate character. The patient is usually spare but not emaciated.

Cerebral symptoms amounting to mania are quite common in advanced cases.

The stomach contents, when analysed by means of a fractional test meal (see Section VII, Chap. 2), show complete absence of hydrochloric acid.

Treatment.—Liver extracts are given intramuscularly to supply the missing principle. Large doses are given at first until the blood picture is normal; this is maintained by regular dosage, the minimum quantity varying with each person. Usually monthly or two-monthly dosage is sufficient. The patient must be impressed with the fact that as far as our knowledge goes at present, this regular dosage is essential to the maintenance of his health for the rest of his life.

Oral administrations of desiccated hog's stomach or of liver extracts is effective so long as it is maintained, and this treatment is sometimes prescribed. It should be borne in mind, however, that any remedy the success of which depends upon a person taking it by mouth over an indefinite period is never satisfactory. Folic acid is now in increasing use.

Blood transfusion in very advanced cases may initiate treatment, but is now seldom necessary, since the liver extracts are so stable and so highly concentrated. Dilute hydrochloric acid is usually prescribed, to be given by mouth before food. This supplies the deficiency and stimulates appetite and digestion. Vitamin B preparations ("Marmite," "Bemax," brown bread) are included in the diet to combat the peripheral neuritis and paralysis. When paralysis is established it can be mitigated to a great extent by patient re-education and encouragement. Massage is helpful, and as soon as the blood picture is within normal limits the patient should be allowed up and encouraged to take moderate exercise.

The diet of any anaemic person should be light but plentiful and should include as many of the iron-containing foods as possible. Appetite and digestion and also the mental condition speedily improve with the general condition.

Comparative Red Cell Count.—

Normal.—

Red Blood Cells	5,000,000 per cubic millimetre.
Haemoglobin	100 per cent.
Colour Index	1

In Pernicious Anaemia.—

Red Blood Cells	2,000,000 per cubic millimetre.
Haemoglobin	50 per cent.
Colour index	1·25.

The colour index is the ratio between the percentage of haemoglobin and the number of red cells in each cubic millimetre of blood. In pernicious anaemia the colour index is always above 1 because the red cells, being larger than normal, carry a greater amount of haemoglobin.

Aplastic Anaemia

This is similar in its manifestations to pernicious anaemia, but it is due to a failure of the bone marrow itself. It runs a very rapid and fatal course and medication by liver extract is of no value. Blood transfusions merely serve to prolong life for a short period.

Secondary Anaemia

Causes.—There are many. The term, secondary, is an indication that the disease is dependent or secondary to some other initial condition. If the cause is known and can be cured the anaemia will disappear.

1. *Haemorrhage.*—This may be sudden and profuse, producing a profound degree of anaemia in a short time. Accident, operation, parturition, may all result in such a circulatory catastrophe, which can be remedied effectively only by blood transfusion. On the other hand the slow haemorrhage from piles or from a leaking gastric or duodenal ulcer will in time produce a secondary anaemia.

2. *Infantile Anaemia.*—Anaemia of infants is usually caused by the tardy introduction of iron-containing foods. The newly born infant has an iron reserve derived from its mother, but this reserve begins to be exhausted at the age of 6 to 9 months.

3. *Pregnancy.*—This sometimes produces an anaemic condition in the mother, since there is a constant drain on her iron reserves.

4. *Poisons.*—Lead, arsenic and similar types of poison may cause anaemia.

5. *Toxic Causes.*—Toxins produced by diseases such as tuberculosis, carcinoma, chronic nephritis and streptococcal infections result in profound anaemia.

6. *Vitamin Deficiencies.*—These, and especially that of vitamin C (the absence of which results in scurvy), may cause secondary anaemia. In scurvy, haemorrhage into joints and tissues is associated with anaemia.

7. *Other Nutritional Factors.*—A very common form of anaemia is prevalent amongst middle-aged women of the working classes. The family is probably fed at the expense of the mother, whose diet consists mainly of bread and tea. The symptoms and signs are typical of anaemia, the patient complaining of increasing weakness (asthenia). The red cells in this type of disease are smaller than normal. For this reason, this variety of anaemia is known as microcytic or hypochromic anaemia.

Treatment.—Removal of the causative factor is of primary importance. Blood transfusion may be necessary in some cases. Iron is the most useful remedy we have in all cases of secondary anaemia; it is given orally in very large doses, as the body can utilize only a small percentage of its intake. Administration of iron must be continued for some time after the blood count is normal. Liver is of no value except as an extra article of diet.

Agranulocytosis

In this disease certain of the white cells known as granulocytes disappear from the blood.

Causes.—Agranulocytosis is often due to the toxic action of certain drugs, e.g. some of the barbiturates and the sulphonamides.

Symptoms and Signs.—Severe throat and mouth infections, which do not respond to the usual methods of treatment, deteriorate until sloughing of an extensive area occurs. Unless the disease is quickly brought under control it proceeds rapidly to a fatal termination.

Treatment.—This should be prophylactic in the first instance. A white cell count of patients under prolonged sulphonamide therapy should be made as routine. (See Section VIII.) When the disease is established injections of pentnucleotide offer the only hope of cure. When this is successful in promoting granulocyte formation, penicillin is given to clear up the septic condition.

Polycythaemia

Polycythaemia is a condition in which the number of red cells is increased up to sometimes as much as 15 million per cubic millimetre. This is thought to be due to overactivity of the red bone marrow, but the cause is obscure.

A mild polycythaemia occurs as a result of living in high altitudes, and in certain diseases. It is then a compensatory effect, the body producing more red cells in an effort to supply sufficient oxygen for its needs.

Symptoms and Signs.—The symptoms and signs are dizziness, noises in the head, headache and a characteristic dusky redness of the face. There is a liability to thrombosis owing to the increased viscosity of the blood.

Treatment.—At present this is unsatisfactory. Venepuncture may give temporary relief.

Other Blood Diseases

Haemophilia.—Certain persons are known as "bleeders." They have great difficulty in stopping the bleeding from even the smallest cut, and it is a serious matter for them if they happen to be the victims of accidental laceration or other accidents. Haemophilia undoubtedly runs in families, but whereas the males generally demonstrate the weakness, it is the females who transmit it. The cause is some defect in the mechanism of blood clotting (see Vol. I, p. 146). In some cases there is deficiency of calcium chloride in the blood. An attack of bleeding from the nose, a visit to the dentist or a surgical operation may have dangerous after-effects in bleeders. Occasionally blood transfusion is successful. Those who are known to be bleeders must adopt every precaution to stop haemorrhage when it occurs. The taking of calcium lactate internally often has good effect, while locally application of adrenalin chloride is helpful. A preparation from the Russell viper has recently been used with success. It is applied locally and usually produces satisfactory clotting. Daughters of haemophiliacs should be advised not to marry.

Paroxysmal Haemoglobinuria.—This is rather a rare condition. Haematuria is the condition in which blood cells themselves are present in the urine, but when the haemoglobin of the blood is expelled from the corpuscles and appears as such in the urine by spasmodic accumulations, the disease is called paroxysmal haemoglobinuria. This is a very serious trouble, since it indicates constitutional disease such as syphilis. It is very difficult to control. The signs are sudden sickness, rise of temperature, especially after some unusual emotion, sudden change of weather or emotional distress. The urine becomes as black as ink, the condition persisting for a few days then disappearing as quickly as it came.

Purpura.—Purpura is an interesting condition and it is not clear whether it is due to the blood itself or to the weakness of the vessels. It is characterized by the occurrences of subcutaneous haemorrhages from the smallest vessels, there being formed a crop of purple patches, resembling minute bruises. It may be found during measles, but is also associated with certain

drugs, such as quinine, mercury and copaiba; sometimes it is found in severe heart or renal disease; it may be one of the signs of locomotor ataxia. There are also certain types of purpura which apparently begin as primary affections. These are as follows.

1. *Henoch's Purpura.*—This is common in children and is often mistaken at the start for intestinal inflammation, such as appendicitis. There may be vomiting, diarrhoea or colic, and often the joints are swollen. The temperature rarely rises. The eruption may be seen in the neighbourhood of the joints and inside the mouth, and there is probably a focus in the pelvis of the kidney, since haematuria is common. Relapses are common, and the disease may end fatally if not controlled.

2. *Purpura Rheumatica.*—Purpura rheumatica has no association with rheumatism. It occurs at various areas and is accompanied by swelling of the joints. The slow bleeding may ultimately cause a grave debility, with swelling of the feet and ankles.

3. *Septic Purpura.*—This is the result of long-standing sepsis and is indicative of the poor quality of the blood. It is often a terminal sign of prolonged septicaemia.

4. *Thrombocytopenic Purpura.*—Here the spleen is too active in destruction of blood platelets (thrombocytes) so that subcutaneous haemorrhages occur, as well as bleeding into mucous membranes. Splenectomy cures the condition.

Treatment.—Fresh air, good food, laxatives, rest, are all that can be advised. Sometimes calcium lactate is given, but it is not entirely successful.

Leukaemia.—The outstanding feature of this disease is great increase of the white blood cells. There are 2 fundamental types: 1. myelocytic leukaemia, in which the polymorphonuclear cells, the marrow and the spleen are mainly affected, and 2. lymphocytic anaemia in which the lymphocytes and the lymphatic glands are the abnormal features. The cause is still unknown but the primary factor seems to be some defect of the structures which generate white blood cells. It is commonest in male adults and usually has a rapidly fatal termination. There are numerous theories, the chief being that the changes occur as the result of a microbic toxaemia, but no specific organism has been found. The blood on examination shows an enormous increase of the particular leucocytes involved, as many as 250,000 being counted in a cubic millimetre, as compared with 6,000 to 7,000 normally. The disease may start suddenly or as a sequel to a severe illness, the common signs being bleeding from the gums, great fatigue and general debility. The spleen is greatly enlarged and bulges on the left side. Slight fever and diarrhoea may terminate the disease. Although patients may linger on for a year or two, the outlook is very grave. Treatment is unsatisfactory, all kinds of antiseptic and antitoxic injections having

failed completely. It is true that x-ray therapy has to a certain extent prolonged life in myelocytic cases, but this and other methods, such as the use of radium, have not succeeded in effecting a cure. The giving of arsenic brings temporary relief only. To sum up, leukaemia is still an unconquered disease. Many modifications and transitional forms of this disease are described as chloroma, pseudo-leukaemia, leukanaemia and so on.

Lymphadenoma.—The commoner name for this disease is Hodgkin's disease. In many ways it is like leukaemia, but chiefly because it is so mysterious and fatal. The features of lymphadenoma are progressive enlargement of the lymphatic glands, beginning in the neck and extending quickly to the axilla, groin and other places. There is also marked reduction of the red blood corpuscles, recurrent attacks of fever, great debility and wasting of the body and haemorrhages at various areas. The neck may be very swollen and unsightly owing to the great involvement of the cervical glands, but there is no pain, no suppuration and no resemblance to the adenitis of tuberculosis. There is also enlargement of the spleen. The treatment is very unsatisfactory; to remove the affected gland early does not get at the root of the trouble, which is possibly in the blood. All the forms of treatment referred to in the treatment of leukaemia have failed equally in lymphadenoma, which in the best circumstances may be expected to linger on for 3 years before it terminates fatally.

Splenic Anaemia.—Sometimes this disease is dealt with under diseases of the spleen itself, but it may be classified with the blood diseases, as there is severe anaemia with enlargement of the spleen. There is a reduction of both red and white cells, the condition being akin to chlorosis, with great deficiency of haemoglobin. Haemorrhage occurs, especially from the stomach and bowel. The last stage is that of an increase in the fibrous tissue of the liver known as cirrhosis. There are 2 types, very closely allied, viz. Banti's disease, which, as above, progresses slowly for 4 or 5 years, and Gaucher's disease, in which the spleen and liver are affected greatly from the start, but anaemia may be delayed. In both cases the only hope of prolongation of life is early removal of the spleen; this has the effect of saving life, although the patient is handicapped. Otherwise the patient may linger on for 4 or 5 years.

Acholuric Jaundice.—In this disease the red blood cells are in a very fragile state and liberate their haemoglobin into the tissues, which become jaundiced owing to formation of bile pigment. The spleen is also enlarged. This disease may arise soon after birth or in late life and runs in families. Treatment need not be resorted to; many sufferers live a long life although hampered by the relapses. Splenectomy has had success.

CHAPTER 2

DISEASES OF THE HEART AND BLOOD VESSELS

GENERAL SURVEY. CAUSES. CLASSIFICATION. PERICARDITIS. CAUSES. SYMPTOMS. TREATMENT. ENDOCARDITIS. VARIETIES. CAUSES. SYMPTOMS. COMPLICATIONS OF MALIGNANT ENDOCARDITIS. TREATMENT. MYOCARDITIS. TREATMENT. CHRONIC VALVULAR DISEASE OF THE HEART. CAUSES. CONDITION OF THE VALVES. CONDITION OF THE HEART. TYPES OF CHRONIC HEART DISEASE. SYMPTOMS. TREATMENT. CONGESTIVE HEART FAILURE. CAUSES. SYMPTOMS. TREATMENT. ABNORMAL RHYTHM. TACHYCARDIA. PAROXYSMAL TACHYCARDIA. PALPITATION. ANGINA PECTORIS. CORONARY THROMBOSIS. CONGENITAL HEART DISEASE. ARTERIOSCLEROSIS. SYMPTOMS. TREATMENT. ANEURYSM. VARIETIES. CAUSES. COURSE. SYMPTOMS. TREATMENT.

HEART disease may be regarded in its widest sense as disease not only of the heart itself, but of the blood vessels and of the other parts of the circulatory system. It is true that we can make certain limitations regarding the site of disease affecting this huge field, but it must never be forgotten that disease at one part of the circulatory system has its influence on very distant regions; it is best to study heart disease as a general disease of the blood-distributing machinery, with special emphasis on certain parts of the machine more seriously affected than others.

General Survey

The general signs and symptoms of heart disease depend upon the degree of failure of the work normally done. Thus fainting attacks, shortness of breath, blueness of the face, difficulty in breathing, swelling of the ankles, pallor and many other well known evidences of heart and vessel defect become outstanding features of the case when there is marked disorganization of the output of the system. We sum up the amount of circulatory inefficiency by making an assessment which takes into account all the signs and symptoms; these we have to weigh up carefully before coming to a decision. Meanwhile it is advisable to

make a brief survey of the chief diseases affecting the heart and vessels, after which it will be easier to understand the various complications of heart failure.

Causes.—These may best be remembered if they are associated with the following age groups.

1. *Infancy.*—The disease is always congenital.

2. *Childhood and Adolescence.*—Rheumatic fever and chorea are the chief causative agents and are responsible for the occurrence of the disease in the pericardium, myocardium and endocardium. Chronic disease of the valves—particularly the mitral valve—can most often be traced to an attack of rheumatic fever or chorea in early life. Diphtheria and other acute infections may produce a toxic myocarditis which may even prove fatal; if, however, the child survives, damage to the heart is not as a rule permanent.

3. *Adult Life.*—Syphilis is responsible for a great deal of damage to the heart and blood vessels. Hyperthyroidism, if not dealt with, produces a degenerative condition of the myocardium with ultimate signs of heart failure.

4. *Old Age.*—Heart disease manifesting itself for the first time late in life is usually due to arteriosclerosis with hypertension. Angina pectoris and coronary thrombosis, although sometimes occurring earlier, usually afflict persons over the age of 50 years.

Classification.—In studying the diseases of the heart, we find it convenient to divide our work into 4 sections, dealing respectively with diseases of the covering of the heart (pericarditis), diseases of the muscle of the heart (myocarditis), diseases of the lining membrane of the heart (endocarditis) and diseases of the vessels themselves. It will be understood that these sections must occasionally overlap.

Pericarditis

The pericardium is the bag in which, so to speak, the heart is kept. Disease of the pericardium must therefore have a certain effect on the heart muscle. Pericarditis is an inflamed condition of the pericardium, usually resulting from constitutional disease or from some infective condition elsewhere. The small space between the two layers of the pericardium is normally occupied by just enough fluid to allow of easy lubrication. If we examined the pericardium in a case of pericarditis, we should find on separating the layers that their surfaces are covered by a sticky layer of fibrinous matter, very similar in appearance to a bread-and-butter sandwich when the two portions are disconnected. To this " bread-and-butter " type of pericarditis, the term plastic or dry pericarditis is applied. In most cases

however, the disease progresses until the pericardial bag bulges with fluid (20 to 60 ozs.). When the fluid is absorbed the two layers of the pericardium stick tightly together, forming adhesions which affect the free action of the heart. In very advanced cases blood or pus may be found in the pericardial space. The great danger from pericarditis is spread of the inflammation to the myocardium or heart muscle proper.

Causes.—The following infectious diseases may spread their micro-organisms to the pericardium by the blood stream: rheumatic fever, St. Vitus's dance, scarlet fever, measles, influenza, typhoid fever, pneumonia, blood poisoning, tuberculosis. The constitutional diseases which may give rise to pericarditis are cancer, nephritis, diabetes, gout and scurvy. Now and then pericarditis may result from spread of the inflammation from adjacent areas or from actual injury.

Symptoms.—In dry pericarditis there may be little or no complaint except that of slight pain over the left side of the chest. When the fluid increases, however, there is great sense of distress in the region of the heart, with some tenderness and occasional pain at the lower part of the sternum. The temperature is irregular and swinging. The whole attitude of the patient is one of restless discomfort; his face is dusky-pale, he is troubled with a short irritating cough which brings him no relief and he has marked dyspnoea. The pulse may be irregular and it is always rapid. Collectively these signs indicate the labouring of a heart partially throttled by the surrounding bag of fluid. There are numerous confirmatory signs to be made out by the methods of inspection, palpation, percussion and auscultation; all of these belong to the province of the physician and do not concern the nurse. The outlook is very grave, especially when much fluid is present. The dangers are chiefly those of inflammation of the heart muscle or of the lining of the heart, as well as permanent interference with the heart's action by adhesions.

Treatment.—Rest in bed is essential, with complete mental and physical quiet. The semi-recumbent position is usually the most comfortable. Visitors should be strictly limited as to their number and time of their stay; only near relatives should be allowed in. All exertion must be avoided as far as possible. The patient must be spoon fed. Two nurses are required to lift him on and off the bedpan, and all nursing procedures should be carried out with the least possible disturbance to the patient.

Diet.—Small amounts of fluid given at regular frequent intervals are probably sufficient at first. Throughout the illness the diet should always be light and digestible, but care must be taken that the patient is having sufficient nourishment.

Medication.—If the disease be of rheumatic origin sodium

salicylate will be prescribed. Sulphapyridine has been tried in some cases and improvement reported.

Relief of Pain.—The application of an antiphlogistine poultice or of an icebag is a soothing form of treatment. In many severe cases, when an enormous amount of fluid is impeding the heart's action, paracentesis (puncture of the pericardial sac) may be performed. Leeches are sometimes used to relieve congestion.

Operative Treatment.—Adhesions or calcification of the pericardium may occur as a result of inflammation or suppuration. Pericardectomy (partial removal of the pericardium) has recently been performed with success.

Endocarditis

We have observed how the inflammatory process is set up in the covering membrane of the heart; a very similar condition occurs in the lining membrane of the heart. The general term, endocarditis, is applied to all inflammations of the endocardium. The great danger of endocarditis is permanent destruction of the great valves guarding the chambers and the outgoing arterial trunks.

Varieties.—Three chief groups can be defined: 1. simple (or benign) endocarditis; 2. ulcerative (or malignant) endocarditis; 3. subacute endocarditis. It can well be imagined that a simple endocarditis may develop into a malignant endocarditis, depending upon the virulence of the bacteria in the blood stream constantly passing over the valves. The damage done to the lining of the heart is in relation to the intensity of the infection. The simple type of endocarditis shows that at the points of contact of the valve curtains small warty growths called vegetations are to be found; they are analogous to the "bread-and-butter" of pericarditis. Since they are easily detached, they are dangerous from the point of view that commonly they become loosened, and getting into the blood stream, block terminal arteries and produce the condition of embolism. When endocarditis has progressed to the ulcerative stage the valves are eroded and later they may show evidences of distortion and destruction, a serious matter involving defect of function and disorganization of the work of the heart. The heart muscle is more or less involved in the inflammatory process. Altogether endocarditis, whatever its degree, is a most dangerous disease.

Causes.—The factors which are at the root of pericarditis also cause endocarditis. Outstanding are acute rheumatism and scarlet fever; in fact, these diseases are always closely watched for heart complications. The malignant type is often caused by some septic condition in another part of the body.

Symptoms.—When simple endocarditis supervenes on a case of rheumatic fever, for instance, the only evidences may be those of increased temperature and pulse, together with dyspnoea. The patient appears to tire more easily. Often the onset of endocarditis is discovered only by careful examination by the doctor, who hears with his stethoscope the sounds known as murmurs, which indicate deformities of the valves and leakage through defective curtains. In the malignant type there are rigors with much perspiration, high temperature swinging widely in 24 hours (septic type) or a state which very much resembles advanced typhoid fever (typhoid type). Ulceration may also recur years later on the old sites of previous simple endocarditis. This gives rise to serious fever as above and is a very dangerous condition, often fatal: it is known as the cardiac type. Subacute endocarditis begins often with general constitutional weakness and debility; the patient is apparently "rundown" and anaemic, and develops what is called, for want of a better name, a "chill." Close examination however would show that the spleen is enlarged and that probably on the site of old valve ulceration there has developed a fresh crop of infectious matter, giving rise to typical signs. This may rapidly progress to a fatal termination.

Complications of Malignant Endocarditis.—Particles of infective vegetations become detached from the diseased valves, and enter the blood stream. These are known as emboli. Small emboli under the skin give rise to purpuric patches and tingling sensations in fingers and toes. Larger ones may reach any organ, e.g. the kidneys (where they cause pain with haematuria), the eye (causing optic neuritis) or the brain (resulting in paralysis, coma and sudden death).

Treatment.—The general nursing treatment is similar to that outlined for pericarditis, every effort being made to conserve the strength of the patient. In the septic or bacterial type of the disease, high temperatures, rigors and profuse sweating make frequent warm sponging necessary. This should be done as quickly and as gently as possible with the least possible effort on the part of the patient. Proneness to bedsores is a feature of the disease and pressure points must be carefully watched and treated. An airbed or ring is essential. The bowels must be kept well open as in every septic condition, but purging must be avoided and if necessary glycerine suppositories, or a small glycerine enema, may be given. Urine is tested daily for albumin and blood, which if present may indicate the presence of renal emboli.

The only effective medical treatment of any bacterial type of endocarditis is by penicillin, which is given as a continuous

intramuscular drip, or by 3-hourly injections over a period which varies from 10 to 28 days. Up to 500,000 units are given daily. During this treatment a blood culture is frequently performed to ascertain whether the number of bacteria in the blood stream is diminishing or not. Previous to the advent of penicillin this septic type of endocarditis was invariably fatal, but although penicillin is reported to control the infection and life is thereby saved, the damage done to the heart itself is irreparable.

Myocarditis

Acute myocarditis is usually part of pericarditis or endocarditis, the heart muscle being affected by spread of the disease from these sources. Myocarditis may also occur in certain infectious states, particularly diphtheria. It often occurs to a limited degree after typhoid fever and influenza. The heart muscle becomes flabby, degenerated and impotent, and the rhythm is upset, the pulse becoming irregular. The patient may suddenly drop down dead; more commonly he has recurrent fainting attacks during convalescence.

Chronic myocarditis is the result of some prolonged strain on the heart and may result in the following different types.

1. *Hypertrophy of the Heart.*—This results from any disease causing overwork of the heart muscle, which ultimately reacts by an increase in the size and number of its fibres. Endocarditis, pericarditis, pulmonary disease, high blood pressure, excessive eating and drinking and in general a highly strung life are all causative factors. The increase in muscular tissue is sufficient for the added work undertaken, but as time goes on the heart degenerates and heart failure results.

2. *Dilatation of the Heart.*—A fright, or a sudden strain of body or mind, or acute poisoning from alcohol or tobacco may cause sudden and acute dilatation, resulting in a fainting attack (syncope). But dilatation can also follow the various diseases mentioned above as leading to hypertrophy. The muscle is so weakened that its contractility is lost and it reduces the heart to a state of flabbiness, the organ, when full of blood, bulging like a bag. In some cases there is a pre-existing hypertrophy, but the degenerated muscle cannot cope with the pressure of the blood inside the heart. Heart failure also results.

3. *Fatty Heart.*—Another form of degeneration may be found in cases of prolonged poisoning by alcohol or other agents, in anaemia, in continuous overstrain of the heart by mental or physical influences, in severe acute myocarditis, but particularly in disease of the coronary arteries, which actually supply the muscles of the heart with blood. It is associated with old age, and is a common sequel of pernicious anaemia. Under the

microscope, it is seen that many fibres have been replaced by a collection of small fatty globules, while others are in an advanced state of degeneration. Naturally the muscle becomes flabby, greasy and generally unfit for its work. This condition has nothing to do with obesity; it is a much more serious complaint, the presence of fat being a degenerative sign and not in any way connected with adipose tissue in other parts of the body. The general signs are poor circulation, especially of the feet, shortness of breath after small extra effort, a tendency to sleep at odd times (especially after a meal) and sudden attacks of unconsciousness which are rather like epilepsy. The pulse may be very slow and is often irregular. Sudden death is common.

4. *Fibroid Heart.*—This is a condition of fibrous degeneration of the muscle, often resulting from obstruction of one of the coronary arteries. It may also occur as an ordinary degenerative sign of old age or as one of the manifestations of syphilis. The symptoms and course are much the same as those of fatty heart. A common sequel is Adams-Stokes disease, or paroxysmal bradycardia, in which the features are sudden fainting attacks, accompanied by a very much reduced rate of the pulse.

Treatment.—Rest and careful dieting may do more than drugs. The directions given in the case of pericarditis and of endocarditis apply equally in these cases. Fluids should be given 15 minutes after meals and should be drunk slowly.

Chronic Valvular Disease of the Heart

As a result of endocarditis, the valves become distorted, overgrown or generally wasted, causing defective closure of the valves and consequent leakage of the blood through the orifice. Nature does all she can to compensate for this by bringing about changes in the circulatory apparatus, but there is a limit to everything and ultimately the patchwork structure breaks down, giving rise to numerous well marked symptoms and signs. In addition to the above, however, there is a group of valvular degenerations which are the result of a slow but steady wasting of the cusps.

Causes.—The causes of the latter group are similar to those which lead to chronic myocarditis, viz. syphilis, chronic alcoholism, chronic nephritis and prolonged mental or physical strain. The great difference between the first group and the second is that in the former the mitral valve is affected early in life, whereas in the latter the aortic valve is affected chiefly after middle life. Any valve may be involved, but the 2 examples mentioned are the commonest.

Condition of the Valves.—If we examine the affected valves we find changes compatible with the extent of the disease.

It is amazing to discover to what extent the damage occurs and how the patchwork of the valve structure is carried out. The whole valve may be like hard leather; the cusps may be wrinkled and shrivelled; in some cases the cusps have fused together; extensive calcification may be found. Thus the mitral valve may be reduced to a dense, hard, funnel-shaped canal, with a rigid opening into the left ventricle which will admit only the tip of the finger. The aortic cusps may be so worn away that they appear as mere excrescences on the vessel wall, totally unable to stop the backflow of blood after the ventricle has made its effort of contraction. For all practical purposes the valve has ceased to exist. We thus define 2 great and important varieties of valve degeneration; 1. stenosis, a condition of heaped-up and over-developed fibrous tissue reducing the valve to an immobile narrow canal, and thus obstructing the flow of blood; and 2. the regurgitant type, in which owing to wasting away by erosion or other form of degeneration, the valve cusps do not function or function poorly, allowing the blood to regurgitate into the chamber from which it has just been driven.

Condition of the Heart.—The immediate reaction to these changes is hypertrophy of the heart muscle. Sometimes the muscle is able to accommodate itself to the new and more difficult conditions and compensation is said to be established. But, as we have already seen, the slightest extra strain—over-work, worry, infectious disease—may bring about degenerative changes in the heart muscle itself and dilatation may result. This may be temporary, but often the effects are permanent and heart failure (described below) follows. The patient can go on only as long as his reserve power, which may be considerable, is available. After this power has been used up it is inevitable that the whole circulatory system should break down; in other words, that heart (or cardiac) failure should be produced.

Types of Chronic Heart Disease.—Four well-defined types are recognized. The nurse must meet with these names frequently in her career; each one is interesting from the doctor's point of view, because it presents to him certain peculiar signs on clinical examination, but to the nurse the important factor is the management of the case from the nursing point of view. In order of frequency the following are found: mitral regurgitation; mitral stenosis; aortic regurgitation; aortic stenosis. Men are much more frequently affected with aortic regurgitation than are women; mitral stenosis is a disease of females more than of males.

Symptoms.—Many of the symptoms of chronic valvular disease are classical. They collectively form a picture inseparably associated with injuries to valves, and the nurse would do well

to study these symptoms so that she may be able to recognize the various heart conditions she may encounter.

First there is the question of compensation. If the heart should react normally to the defective valve, there will be hypertrophy, the bulk of the muscle increasing and the general power of the fibres becoming greater. Many people can go about their ordinary day's work without showing apparent evidences of cardiac hypertrophy, but if they were more closely watched it might be noticed that any extraordinary effort—such as running for a train, or lifting a heavy weight—caused acute breathlessness out of proportion to the effort. Similarly fatigue would occur in the middle of the afternoon. Gradually it would be evident that the circulatory system was feeling the strain, and as the heart slowly lost its compensation the following symptoms and signs might be found. The degree and occurrence would vary with the condition. Compensation might be re-established after temporary breakdown.

1. *Dyspnoea.*—Shortness of breath is one of the first signs. As compensation fails more and more, dyspnoea becomes increasingly part of the picture until it is so distressing to the patient that he is forced to sit bolt upright in bed.

2. *Pain.*—The pain varies from a dull ache in the region of the heart to a sudden acute attack of severe pain known as angina pectoris. The pain of flatulence or of indigestion, commonly believed by the layman to be due to cardiac lesions, must not be misinterpreted by the nurse. On the whole pain is not an outstanding symptom of heart disease, but when it does occur it is a serious one.

3. *Cyanosis.*—Blueness of the face, of the hands, feet, ears and other terminal areas of circulation are signs that the oxygen exchange is poor and that the pulmonary system is unable to clear the blood because of the congestion. The purple discoloration becomes intensified as the congestion of the lungs increases and other parts of the body may become tinged with blue.

4. *Palpitation.*—Fluttering of the heart may be a symptom of nervous irritability and may occur quite apart from valvular involvement, but with a history of rheumatism, and when a stolid, unimaginative patient is concerned, palpitation must be regarded as a serious upsetting of the normal rhythm of the heart due to dilatation.

5. *Oedema.*—Probably this is the most characteristic sign of congestive heart failure. It is due to the damming back of fluids in the tissues as a result of the weak power of the circulation. To begin with, oedema may be apparent only at night or after a prolonged effort, but it is like a barometer of the heart "weather": when the heart is failing oedema increases; when it is gaining in strength oedema disappears. Usually it is most evident at the

ankles, where a tense, boggy thickening of the tissues obliterates the bony landmarks. When the finger is pressed on the skin, it sinks to a certain depth, leaving a characteristic pit familiar to all who are in daily touch with cardiac cases. The feet are cold and have a waxy appearance. Oedema may spread to the hands, to the back, to the lax tissues below the eyes and indeed it may become generalized, when it is known as dropsy. Dropsy may occur in kidney disease also. Accumulations of fluid may gather in the thorax and in the abdomen; to these we apply respectively the terms hydrothorax and ascites; if the dropsy be marked in the subcutaneous tissues, the condition is called anasarca.

6. *Dizziness.*—Dizziness, or feelings of faintness, may occur when the blood supply to the brain is poor, but fainting is not always a sign of heart weakness. It is more probably due to nervousness or anaemia, but like pain it is often misinterpreted by the patient who imagines himself to have a weak heart.

Treatment.—There are various ways in which a patient is forced to seek medical aid on account of heart disease. In the first place, he may experience valvular weakness during the course of rheumatic fever, scarlet fever or any of the diseases already referred to. Secondly he may find that his compensation is failing in an already established valvular defect. Thirdly, he may be the victim of a reinfection of an old lesion, causing sudden and severe symptoms. Lastly he may struggle on, fighting to keep the heart going against odds until he is laid up with heart failure. For the present we shall confine ourselves to the treatment of temporary loss of compensation.

Mitral disease is usually associated with coughing, extreme dyspnoea, marked cyanosis of the nose, lips, face and fingers and general distress. As the heart becomes more and more flabby and less and less active, the patient is forced to seek rest in bed. Aortic disease, on the other hand, is characterized by pallor, dizziness (especially after sudden change of position) and loss of mental concentration owing to weak cerebral circulation; the patient has a feeling of great fatigue. The clinical examination of such cases by the doctor demonstrates numerous abnormalities of size and function of the heart; the stethoscope discloses the presence of abnormal heart sounds; the sphygmograph and the polygraph give diagrammatic pictures of the pulse; the electrocardiograph elucidates many of the mysteries of rhythm; the orthodiagraph actually shows the x-ray picture of the heart in action. All treatment of modern type is decided upon after careful assessment by the above scientific methods.

In a way it is a good thing that the heart muscle becomes tired and gives up the struggle for compensation. This forces the patient to seek rest in bed, which is *par excellence* the first

step in the treatment of heart disease. The bowels must be kept fairly loose by regular daily salines, of such strength that a free watery motion is obtained without causing pain or discomfort to the patient. Constipation must never be allowed to occur in heart cases; it is essential to keep down all possible sources of toxaemia and congestion. We are treating not only the injured valve; we are dealing with a general situation, demanding the maximum relief to all the work of the body. For this reason it is also necessary to see that the patient's rest is complete; all effort, mental and physical, should be reduced to the minimum. The nurse must serve her patient hand and foot. A light, simple dry diet is best. Fluids should be given about 15 minutes after food. It is better to give small meals at more frequent intervals than normally. New remedies are being added every day and the greatest care must be taken in the administration of heart tonics such as digitalis, camphor, strychnine, strophanthus and quinidine, the slightest untoward effect being reported by the nurse at once. The great work of Sir James MacKenzie showed that it is not wise to prolong the period in bed beyond the stage at which the compensation is fully re-established. Just as a child requires to be taught to walk. so must the patient be re-educated to do the full work his heart is capable of doing. Massage and passive movements followed by graduated exercises lead to short walks and finally to the routine decided upon as within the limits of the heart's endurance and many sufferers from cardiac defects can do good work as long as it is not beyond the scope of their strength. The nurse has a great duty to her patient at all times, but especially so in training him for a resumption of his work. Determination and perseverance, combined with a complete understanding of the limitations of the case, may save a patient from a life of neurosis and worry and allow him to preserve a placid mind about his health. The patient should be made to understand that he cannot take undue liberties with himself, however; the nurse must see that he knows exactly how far he can go.

Congestive Heart Failure

Although congestive heart failure is intrinsically bound up in chronic valvular disease, it is best studied as a separate condition since it is a very serious complication of all types of heart disease, and may occur as a temporary or a terminal phase of such affections.

Heart failure means that the already burdened heart has made its maximum effort and has failed in the race. Like the racehorse or the athlete who cannot stay the course, the heart keeps up to the limit of its endurance and then has a sudden and

dramatic collapse or a less acute but equally overwhelming gradual breakdown, with complete disorganization of the whole system. It is a critical condition, the slowing of the circulation causing dangerous reactions in all parts of the body.

Causes.—Most of these have already been mentioned in the preceding pages under various headings and include acute and chronic valvular disease, endocarditis, pericarditis, myocarditis and all other affections of the myocardium, comprising hypertrophy, dilatation, coronary disease and continued high blood pressure due to thickening of the arteries.

In most cases heart failure is of gradual onset. Like a power-station defect in an electrical supply, the light flickers, becomes dim, makes a feeble rally and then completely fades out. The heart engine never stops, but its work is of little avail in the normal economies of the body and the complete disorganization is as serious as if the heart had ceased work altogether.

Symptoms.—The most acute symptom of all is sudden death. Such extreme collapse, however, does not concern the nurse, whose duty it is to deal with cases ranging from very complete breakdown, with life in the balance, to less severe defects demonstrating some or all of the following signs and symptoms.

Cough and blood-stained sputum (haemoptysis) indicate marked congestion of the lungs with fluid; the lung tissues are waterlogged. The breathing may be so difficult that the patient cannot remain in bed and may have to be put in a chair, as already described in Vol. II, Section VI. There may be extreme degrees also of anasarca, of ascites or of generalized dropsy. The danger of the condition is usually indicated by the extent of the fluid invasion of the lax tissues. The last stages of heart failure can never be forgotten once they have been observed. The huge bulk of the patient, powerless to get his breath, the tense skin, the purple, dusky complexion, the coldness of the extremities and the short unavailing cough prove that the patient is approaching the stage of being drowned in his own fluid. The liver and kidneys are also affected by the congestion. Death often comes after a considerable struggle.

Treatment.—1. Rest in bed while the oedema is present. The patient is allowed to adopt whatever position is most comfortable for him. He is usually propped up in high Fowler's position, but often prefers to lean forward with his arms supported by a cushion on a bedtable. Sometimes he is nursed in an armchair. He is usually sensitive to cold and therefore should be provided with a small blanket next to him.

2. Diet must be light, and anything which causes flatulence should be avoided, e.g. soups and pastries. Small frequent meals are better tolerated than large ones. If there is much

oedema drinks should be limited to 2 pints during 24 hours. A salt-free or salt-poor diet also helps to get rid of the fluid.

3. The bowels are kept open by a daily dose of magnesium sulphate. Violent purging is to be avoided but a watery evacuation relieves oedema.

4. Urine is saved and measured for 24-hour periods and should be tested for albumin, which is often present in large amount. A chart comparing the intake of fluid and the output of urine should be kept.

5. Patients with heart failure are often restless and sleep badly. Luminal (½ to 2 grains) may be prescribed. Paraldehyde (1 to 2 fluid drachms by mouth in water or 2 to 4 fluid drachms in water per rectum) is often effective. When the need for sleep is urgent morphine sulphate or hydrochloride (⅛ to ¼ grain) is sometimes ordered.

6. The need to get rid of oedema is of great importance. In addition to saline aperients and the restriction of fluids by mouth, diuretics are injected either intravenously or intramuscularly. The most powerful of these are the mercurial diuretics (mersalyl and "Salyrgan") which act directly on the kidneys and produce the maximum outflow of urine. Care must be taken when injecting these drugs intramuscularly that they are given deeply into the tissues. After the drug has been drawn into the syringe, the needle should be changed to avoid leaving any trace of the drug in the track of the needle. Ulceration of oedematous tissues may result if this precaution is neglected. Mercurial diuretics are best given in conjunction with ammonium chloride, which is prescribed to be given by mouth. Digitalis also acts as a diuretic but indirectly by improving the general circulation. It is a valuable heart stimulant, having an effect on the pacemaker so that there is slowing and strengthening of the pulse. It is cumulative in action and signs of overdose are nausea and vomiting, abnormal slowing of the pulse rate and a characteristic irregularity known as "coupled beats." The urinary output is diminished. Strophanthin is sometimes used but is much more toxic.

7. Other forms of treatment include the following.

Venesection may relieve venous congestion; about one pint of blood is generally withdrawn.

Paracentesis abdominis (tapping of the abdomen) relieves ascites, when diuresis is not efficient.

Southey's tubes may be used to drain oedematous tissues; this is an unpleasant procedure now seldom undertaken.

Oxygen is helpful in severe cyanosis or acute dyspnoea. It is most comfortably and efficiently administered by means of a Tudor Edwards' spectacle frame. (See Vol. II, p. 350.)

The nursing of a case of heart failure requires much tact and patience. The patient is very irritable and exacting and often

appears to be just selfish and naughty. This is characteristic of most forms of heart disease, however, and the nurse must try to cope with it to the best of her ability.

Abnormal Rhythm

Certain disorders of the cardiac rhythm do not occur frequently in hospital practice but are quite common in general practice, and the nurse may encounter them in her private work. Others are found as part of advanced heart disease. Assuming that the regularity of the heart depends upon the inherent properties of certain well defined neuromuscular elements associated with endocrine activity, interference with these gives rise to various forms of arrhythmia known as sinus arrhythmia, extrasystole, auricular flutter, auricular fibrillation and heart-block. The first condition need not indicate disease; the others are all important developments during the course of cardiac failure, except the extrasystoles, which may be found in those who have been working hard, mentally or physically, smoking too much or drinking strong tea, and in these circumstances are rapidly ended when the cause is removed.

Tachycardia.—This is often termed disordered action of the heart (D.A.H.). It is a very common functional irregularity, the result of debility, anaemia and dyspepsia; it occurs in those who suffer from exophthalmic goitre and is often a sign of excessive consumption of tobacco, tea and coffee. The chief symptom is an increased rate of the pulse of which the patient is unaware.

Paroxysmal Tachycardia.—Here the pulse may have spells of rapid action amounting to 150 to 200 beats per minute, and the condition is much more serious. The heart muscle is bound to suffer from such overwork. The patient is restless and irritable; he becomes utterly exhausted and a few weeks in bed is an essential part of the treatment. The fault lies in the muscle bundles which normally transmit much slower rates of beating. Paroxysmal tachycardia may follow acute rheumatism or any of the other infectious fevers; the spasms are easily set up by excitement or emotion, both of which should be avoided. Sometimes application of an icebag to the chest brings relief; susceptible patients should be warned to lead a very placid life.

Palpitation.—Palpitation is a symptom usually mistaken by the patient as indicative of heart disease and therefore intensified by further worry, which itself is generally the initial cause. Nervous persons, suffering perhaps from flatulent dyspepsia, lie in bed at night and hear the forcible beating of the heart, which is probably also irregular; they sit up and become agitated, they

lose sleep, they deny themselves mental and nervous refreshment and as a result they become confirmed neurotics. Young women, living life rather too fully, perhaps, commonly consult doctors about this condition. It is one of the evidences of stress of the modern life and may be evidence of the anxiety neurosis. All the symptoms are indicative of the atmosphere of pressure which dominates the situation. There is a feeling of tightness, not serious enough to be called a pain, over the apex of the heart; there are noises in the head, a feeling of " woolliness " of the brain, flushing of the face and excessive perspiration. Patients often declare they feel as if they might burst at any moment. All these signs are those of the highly strung, imaginative individual, easily influenced by the slightest changes in the environment. Treatment should be on general lines; the strong mind of the nurse may persuade the patient that nothing of a serious nature is at work. Stimulants of all kinds are better avoided and the cigarette habit should be controlled. Many doctors give bromides and a drug of the veronal group. Exercise and fresh air should be the rule.

Angina Pectoris

Angina pectoris, popularly known as " breast pang," is a somewhat difficult disease to explain. In the first place there may be little or no evidence of it until the initial attack occurs; this may end fatally in a few minutes. Generally, however, there are warnings of the disease, in the form of mild seizures which give place to typical anginiform attacks later on. Angina pectoris can be summed up by describing the attack as an excruciating pain in the region of the heart, with a peculiar feeling of impending death. The cause is primarily in the coronary arteries, which become narrowed or obstructed and which thus fail to provide the heart muscle with its normal supply of blood. The heart muscle, therefore, has periodic lapses of function, and it is thought that the pain is due to strain of the walls of the ventricles, to neuralgia or to cramp. There is no doubt that angina pectoris is a disease of the cultured classes and that the strain of worry and anxiety leads to its occurrence, but the exciting cause may be a fit of temper, an overloaded stomach, sudden bad news or a fright. When the attack comes on, the patient is held as in a vice, no matter whether he be at home or in the street. He usually gives a short cry, then clutches at something to support himself, while he turns pale and perspires freely. The expression of the face is indicative of the disturbance in the mind. The pain may be indicated as starting at the sternum and radiating down the left arm. The patient is frightened to breathe. The attacks may last for a few seconds

or a few minutes, but the severity increases as time goes on and there is always the danger of a fatal seizure. The treatment consists of giving nitrite of amyl, which can be carried in the pocket in capsule form, the glass phials being broken into a handkerchief and the fumes sniffed up by the patient during an attack. Chloroform and morphine have also had success. The after-treatment consists of rest and freedom from worry and excitement, the patient being put to bed and treated as for mild shock. A recent development is surgical treatment involving the removal of certain of the cervical and thoracic ganglia of the sympathetic system. Medical treatment of the condition apart from the attacks is centred on the giving of potassium iodide, nitroglycerine and the nitrites in an endeavour to reduce the constriction of the coronary arteries.

Coronary Thrombosis

Most cases of coronary thrombosis are the result of long standing arteriosclerosis and occasionally of syphilis. Men of 60 or over with a high blood pressure are the most common sufferers, although the disease may attack much younger persons. Unlike the pain of angina, the attack is not precipitated by effort but may occur even whilst the patient is in bed. It is an agonizing pain, of distribution similar to that of angina, but it is more distressing, since it continues for hours or days and is unrelieved by nitrites. The patient is usually collapsed; the temperature and blood pressure fall alarmingly and death may occur within a short time. Morphine is prescribed in quite large doses, not only to ease the pain but to relieve the distress, apprehension and restlessness.

The thrombus or blood clot usually occludes one of the branches of the coronary artery. There is death of that part of the heart which is normally supplied by the occluded artery, because the blood supply has been cut off. The dead portion is known as an infarct; this softens, and when the patient exerts himself there is danger that the heart may actually burst. Rest must therefore be prolonged for at least 2 months and convalescence must be gradual. During this time the infarct usually organizes itself into a strong fibrinous scar which, however, is usually thinner than the original muscle.

The nursing must be organized so that the patient is never left alone and is kept absolutely quiet, with a variety of interesting occupations devised by an experienced nurse who appreciates the nature of the case.

Congenital Heart Disease

This condition is not so much a disease as a defect of development. In most cases, however, the symptoms are equivalent to those occurring in cardiac disease. There may be 2 chambers in the heart instead of 4, and sometimes a communication persists between the 2 ventricles or 2 auricles. Foetal endocarditis is usually followed by pulmonary stenosis, this causing extreme cyanosis at birth (blue baby). If the child should survive he is delicate and may be so handicapped by intercurrent lung troubles that he dies before puberty. Typical signs are clubbing of the fingers, stunted growth and shortness of breath. Such children are nearly always mentally backward. Recently operative measures have met with success.

Arteriosclerosis

This is one of the most widespread diseases known. It is a very comprehensive term used to indicate a condition of thickening of the arteries, but the thickening can occur at various places (e.g. the internal coat may be thickened but the external may not be affected). Taken as a whole, it may be said that arteriosclerosis is a slowly progressive disease of advancing age, the degree depending on various factors, including the type of individual, the history of disease and, above all, the amount of wear and tear of life. It is a degeneration which is sooner or later inevitable; when it appears too early in life it becomes a disease out of proportion to the condition expected as a result of ordinary advance of age. While it is therefore almost a normal phenomenon of the "seventies," it is distinctly a serious abnormality in the "forties." Gas pipes and water pipes become corroded with age and acquire a "scale" on their channels. The blood vessels of an old man show a similar state of affairs. The disease has been known for over 3,000 years and its appearance is indicative of some liberties taken with the natural process of life, while heredity plays a certain part, probably on account of the psychological make up of those who fall early victims to arteriosclerosis. The excesses of youth and the worries of middle age lead to an increase of the blood pressure, but the high blood pressure may also result from disease of organic type. The leaders of the world, the thinkers, the creators and all who have great responsibility take more out of their minds than they are expected to do; it is probably one of the penalties of evolution. It is somewhat unsettling to our thoughts to reflect that the same condition may be the result of venereal disease, overeating, excessive drinking, kidney troubles and other defects associated with the idle and the profligate. Recent experiments seem to prove

that too much animal protein in the diet may be one of the chief causes of arteriosclerosis; this bears out what has been said above.

Examination of the affected arteries at various stages shows that the disease begins by a thickening of the inner coat of the artery, with a certain amount of degeneration of the other coats; ultimately the vessel becomes thickened and narrowed in its channel so that the blood has difficulty in passing through. This explains many of the phenomena of generalized high blood pressure. There is a special (atheromatous) type, in which the thickening occurs as raised patches on the internal lining of the artery, usually one of the larger type. Calcium deposits occur, so that the artery seems to contain plates of hard lime. When this cracks or ulcerates a pouch is formed, which is termed an aneurysm. Ulceration is also a common condition.

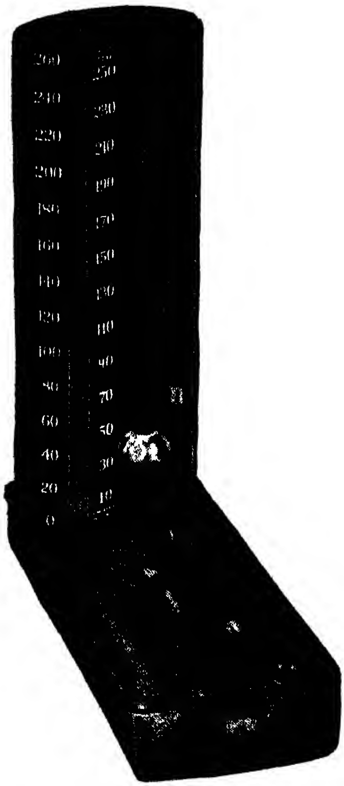


Fig. 59.—Mercurial Sphygmomanometer.

Symptoms.—Much depends upon the system affected. To begin with, the only sign of early arteriosclerosis may be a certain irritability of temper or general restlessness. Examination of the blood pressure by one of the approved mercurial sphygmomanometers (Fig. 59) shows that the blood pressure is too high as compared with the age of the patient. This is of great importance, but there is far too much idle gossip in lay circles about blood pressure. It is useless to quote absolute figures. The assessment of the physical condition from the blood pressure must be made by taking into account all the individual influences of the case. Nurses should refuse to discuss blood pressures with their patients; it should be explained that much misunderstanding has arisen on account of lack of proper interpretation of the blood pressure readings.

As the disease becomes more firmly established the following regional changes are seen.

Circulatory System.—High tension pulse; raised blood pressure; the radial and temporal arteries are noticeably tortuous and hard to the touch; the pulse is difficult to compress; the vessel is like a piece of whipcord; angina pectoris; coronary thrombosis; aneurysm of the aorta; aortic regurgitation; poor circulation.

The Brain.—Dizziness; headache; mental dullness; loss of memory; cerebral haemorrhage (commonly called "a stroke").

The Kidneys.—Frequency of micturition; passage of large amounts of urine of low specific gravity; evidences of uraemia.

Treatment.—The chief thing in the treatment is the institution of a simple routine of quiet living, in which all mental and physical activities are reduced to a minimum. Light diet is essential and all strong proteins, alcohol and so on should be avoided. Many sufferers are difficult to deal with; it is typical of the arteriosclerotic individual that he fights against all restriction. Nevertheless the nurse must insist on rest; great relief is obtained by lying down for 2 hours every afternoon. The bowels should be kept free by a bi-weekly dose of calomel and by salines first thing every morning. Drugs are given more or less as palliatives, the chief being potassium iodide and the nitrite group. The main element in the treatment is the ensuring of a general slowing up of the erstwhile "speeding" of life. The numerous complications must be dealt with as they arise; each is discussed separately later on in this work.

Aneurysm

By the term, aneurysm, we mean a localized bulging of an artery; the condition is permanent. It is very like the condition seen when a weak old bicycle tyre is pumped out slightly beyond the limit of its endurance; small pockets appear and if there is any extensive weakening of the rubber there is a dilatation which is incompatible with the rest of the tube.

Varieties.—1. *Fusiform Aneurysm.*—This is an even, spindle-shaped dilatation—a localized expansion of the vessel involving all 3 coats (Fig. 60, *a*).

2. *Sacculated Aneurysm.*—The bulge occurs on one side only in this case, there is rupture of the inner and middle coats so that the outer coat expands into a sac (Fig. 60, *b*).

3. *Dissecting Aneurysm.*—A rare type, in which the blood forms and uses a new channel by burrowing between two layers, the inner and middle coats (Fig. 60, *c*).

Causes.—Arteriosclerosis, syphilis and, rarely, debilitating diseases such as cancer and tuberculosis. Prolonged strain may also result in aneurysm; blacksmiths, dock labourers, soldiers,

and others have been found suffering from aneurysm without any evidence of other diseases.

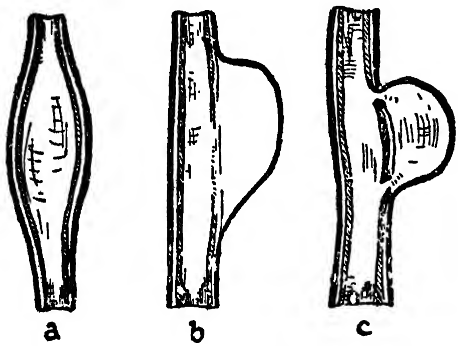


FIG. 60.—VARIOUS TYPES OF ANEURYSM.
a, Fusiform *b*, Saccular. *c*, Dissecting.

Course.—Progress is usually rapid. The sacculated aneurysm presses on other structures and gives rise to discomfort. Ultimately it may rupture. In very rare cases, the blood clots in the sac and automatically shuts off the pouch, so that the normal channel is re-formed and all that remains of the aneurysm is a firm fibrous mass.

Symptoms.—Aneurysm may occur in any artery, but the main area involved is that commonly affected with atheroma—the aorta. The ascending portion, the transverse portion or the descending portion of the arch may be affected, and each region presents slightly different signs. The abdominal aorta, the axillary, femoral and popliteal arteries may also be the sites of aneurysm.

The symptoms of aortic aneurysm are the result of the gradual growth of a fusiform or sacculated tumour occupying the space. In extreme cases, such aneurysms may measure 6 inches long by 3 inches wide.

Briefly the following are the chief features: boring pain behind the sternum, the result of pressure on the bone and on nerves; attacks of angina pectoris; palpitation; unequal radial pulses; difficulty in swallowing; loss of voice; brassy cough (like the hissing of a gander); breathlessness; prominence of the veins of the chest, one side of the face or arms; visible expansile pulsation of the chest at the level of the second costal interspace; unequal pupils; " purring " sensation given to the fingers when the hand is placed over the swelling on the chest. In advanced cases, pressure on or erosion of the spine may cause paralysis. The x-ray picture shows marked shadows above the cardiac region (Fig. 61).

Treatment.—In some cases, particularly with regard to the popliteal artery, it is possible to reduce the flow of blood through the swelling by partial ligature. Clotting occurs and there is a natural cure.

In aortic aneurysm, however, the treatment is mainly palliative, and is concentrated on the relief of the symptoms. Rest is

FIG. 61.—ANEURYSM OF AORTA: RADIOGRAM.
About two-thirds of the upper part of the thorax is occupied by the abnormal swelling.

essential, the minimum of exertion being allowed. Light diet with as little liquid as possible and abstention from alcohol is indicated. After a time there is a danger of increasing the anxiety neurosis, which is a feature of such conditions when the patient is restrained too much. He should be allowed to go out for gentle exercise and to take up some hobby or recreation not involving too much strain. Syrup of iron iodide is a useful tonic and remedy for the condition. But in the long run the main drugs in use are those which soothe the pain, and here morphine is the best. Various methods of local cure have been attempted but all must be regarded as unreliable. Needles, fine wires, strands of horsehair and so on have been introduced in an endeavour to start a process of clotting. The injection of gelatine by the buttock or rectum at weekly intervals has been proved dangerous. Finally the pain may be soothed by diathermy or other electrical treatment, but taken as a whole the treatment of aortic aneurysm is unproductive of much result.

CHAPTER 3

DISEASES OF THE ORGANS OF RESPIRATION

GENERAL SYMPTOMS OF RESPIRATORY DISEASE. COUGH. SPUTUM. OTHER SYMPTOMS. PNEUMONIA. LOBAR PNEUMONIA. BRONCHOPNEUMONIA. ATYPICAL PNEUMONIA. BRONCHITIS. ACUTE BRONCHITIS. CHRONIC BRONCHITIS. BRONCHIECTASIS. EMPHYSEMA. PLEURISY. PHTHISIS. ASTHMA. DISEASES OF THE LARYNX AND TRACHEA. ACUTE CATARRHAL LARYNGITIS. FALSE CROUP. CHRONIC LARYNGITIS. LARYNGISMUS STRIDULUS. TRACHEITIS. OEDEMA GLOTTIDIS. CANCER OF THE LARYNX. OTHER DISEASES OF THE LUNGS AND PLEURA. CONGESTION. INFARCTION OF THE LUNG. COLLAPSE OF THE LUNG. FIBROID PHTHISIS. TRADE LUNG. TUMOURS. ABSCESS OF THE LUNG. GANGRENE OF THE LUNG. PNEUMOTHORAX. HAEMOPTYSIS.

THE respiratory system is closely associated with the circulatory system. Many diseases of the circulatory system have therefore symptoms which are the result of involvement of the respiratory system and vice versa. In the study of the respiratory diseases certain important signs depend upon the reaction of the heart, but the chief symptoms of respiratory disease which lead us to diagnose the existence of something abnormal in the pulmonary system are as discussed below.

General Symptoms of Respiratory Disease

The lungs occupy the major portion of the thorax; it is therefore possible to localize to certain areas the symptoms of pain, difficulty of breathing or complete immobility. Cough, spit, cyanosis and other indeterminate symptoms themselves do not help us to say where the lesion is situated; they merely give a general indication of abnormality of the lung tissues.

Cough.—A cough is an explosive expiration, indicating a desire on the part of the lung tubes to get rid of some foreign irritating matter, usually derived from the lung tissue itself. This leads us to investigate the various types of cough. For instance, when the cough is short and obviously ineffective and

painful, we must at once think of pleurisy or pneumonia; coughing in such troubles amounts to a series of short grunts. The cough of phthisis varies according to the stage of the disease; in the early days, the cough may be recurrent at intervals, the length of which is determined by the amount of lung involved; the phthisical cough is of the "hacking" type, and ends with the bringing up of a small quantity of frothy, blood-stained sputum. When phthisis is established, the cough is easier and results in the expectoration of thick lumps of sputum. The cough of bronchitis may be "tight" or "loose" according to the amount of secretion in the bronchial tubes. A hard, tight cough causes great discomfort and even pain, but the cough of moist bronchitis is noisy, guttural and loose, ending in the expulsion of a large amount of sputum. The cough of asthma is wheezy and very irritable. Whooping cough has a characteristic "crow" at the end of a series of spasmodic efforts and is very like croup in this respect. When there is obstruction to expiration, as in partial closure of the larynx, the cough is high-pitched, harsh and of somewhat metallic character. Apart from the above features cough may be more intense at night than during the day; it may be spasmodic after meals or it may occur when the patient lies in a certain position. The cough may go on regularly or there may be a few minutes' severe coughing, then 30 minutes' peace. The effect on the patient should be carefully noted, special attention being paid to the exhaustion which may or may not follow the cough. All these points demand the nurse's careful study since the doctor relies on her for a report of the patient's progress during his absence.

Sputum.—The expectorated matter (sputum) is very important from the diagnostic point of view and a case is not complete unless the sputum has been carefully tested. This can be carried out by providing the patient with a specially sterilized sputum mug containing a small quantity of distilled water. As soon as one or two expectorations have been coughed up, the nurse should remove the mug, cover it if possible with an upturned glass jar or glass square, and label it carefully. The sputum is then taken to the laboratory, a microscopical examination of a smear on a glass slide is made and a report is sent to the ward regarding the presence of any unusual organisms. It is advisable to wash out the patient's mouth carefully beforehand, using sterile water, bicarbonate of soda and a wooden swab stick with gauze-covered end. The morning specimen of sputum, obtained before breakfast, is best. In many sanatoria, and also for those who are allowed to walk about, a special blue glass sputum bottle is provided which can be quickly and frequently sterilized, thus rendering the sputum harmless. If the doctor asks particularly for a culture-specimen, this may actually be obtained by waiting

with the patient until a cough starts, then getting him to spit into a freshly sterilized bottle held in the nurse's hand, all ready for the purpose. No fluid, antiseptic or otherwise, is used and the sooner the cap is fixed on the bottle and the latter in the laboratory the better for the cultural reaction. Children, and sometimes sensitive adults, have a habit of swallowing the sputum but they can usually be coaxed into giving a specimen. Otherwise the pharynx should be tickled with a sterile throat swab on the end of a thin piece of bone or wood; the reactionary cough usually brings up a quantity of phlegm and the swab receives an ample specimen of it. The latter is then immediately put into a test tube, which is carefully sealed and labelled. It is rarely necessary to employ the method of giving the patient iodide of potassium for two days and allowing him to swallow the increased expectoration which is removed from the stomach by tube, although in extreme cases this may have to be resorted to.

The following facts should be ascertained about sputum. A daily sample should be saved for the physician, and nurses should remember that care must be taken to provide a pure sample, since the sputum mug in male wards is usually the receptacle for matches, cigarette ends, crumbs and many other small waste products of the clinical life. In some cases it is necessary to make an estimate of the amount of sputum passed in 24 hours. The nurse should note whether the sputum is thick or thin, its colour, the presence of froth or the existence of an offensive odour. The characters of the sputum are discussed under each disease but it must be emphasized here that the amount of sputum does not mean so much as do its constituents; if it is nodular, cheesy-looking, tinged with blood or rust-coloured it is a serious sign. Little alarm need be caused by the presence of black particles in the sputum. These are due to soot, inhaled by those who live in congested areas or who work at dirty jobs.

Other Symptoms.—Rate of respiration, dyspnoea, stertor, stridor, cyanosis and other symptoms have all been already described (see Vol. II, Section VI).

Pneumonia

There are two main types of pneumonia. The first is an inflammation of the alveoli of one lobe or more and this is therefore called lobar or croupous pneumonia. The second is an inflammation of the terminal bronchioles, the secretion from the latter passing into the alveoli and filling them up; this is called broncho-pneumonia or lobular pneumonia and occurs chiefly in old people and young children.

Lobar Pneumonia.—The pneumonia of adults may be made notifiable as an infectious disease. It is one of the specific

infections due to a germ called the *Micrococcus lanceolatus* of Fränkel, which is frequently referred to as the pneumococcus. Lobar pneumonia should not be regarded as merely a local inflammation of the lungs but as a general toxaemia affecting the whole body.

Causes.—Changeable weather has much to do with the occurrence of this disease, and the climate of the British Isles seems to be especially favourable to its development, since pneumonia is very common. Probably the greatest number of cases are found at the end of a long, wet cold winter, when people are tired and debilitated after a lengthy spell of sunless weather. Certain persons are susceptible to pneumonia; their blood seems to lack the necessary resistance to the pneumococcus, thus recurrences are common, three and four entering into the history of an individual prone to the disease. Pneumonia is commonest when people are in their prime but it may also occur before the age of puberty and in persons who are approaching senility. The maximum incidence is in males of 27 years of age. While pneumonia is directly due to the increased virulence of the pneumococcus active in weakened surroundings, there are certain contributory causes such as a severe wetting, with probably a history of the patient having sat about with wet feet for an hour or two afterwards, or of constant exposure to draughts, moisture, bad fumes or poisonous gases in workshops. Undoubtedly bad housing, bad ventilation and bad feeding—in short, neglect of the simple laws of hygiene—predispose us to pneumonia. The chronic alcoholic makes a poor fight when he is assailed by pneumonia and a fatal termination is common. While old people succumb easily to the disease, it is very difficult to say what type of the younger generations, is most likely to escape its attack. Very often the man of poor physique and of obvious "weedy" appearance remains free from pneumonia while the strong-looking athlete has a great struggle.

Clinical Picture.—The picture of pneumonia sketched below is considerably modified by sulphonamide therapy. In spite of this, however, the disease is still a serious one and takes its toll of human life yearly. For this reason it is described in detail.

The Appearance of the Lungs.—The disease is much better understood when the morbid anatomy is appreciated. If it were possible to make an examination of the lungs at various stages, 4 main conditions would be found as follows.

1. *Engorgement.*—This is known as splenization, because the tissue is like the spleen. The normal spongy lightness is absent and the affected part, although it contains a good deal of air, is markedly engorged with blood, dark red in colour and oedematous; the alveoli contain a certain amount of light serous froth.

2. *Red Hepatization.*—By the time this stage is reached, the lung is as solid as the liver, hence the name. The tissues are very fragile and break down easily. If we were to put the affected part into water it would immediately sink, because the alveoli are filled with inflammatory products which have become consolidated and to a certain extent fibrinous.

3. *Grey Hepatization.*—Degeneration having taken place, the red coloration has given place to a mottled grey effect. The extent of the degeneration depends upon the virulence of the infection ; usually the lung is very soft, brittle and purulent, but not sufficiently so to cause destruction of the intrinsic structure of the lung. When the lung is squeezed, therefore, the purulent fluid is pressed out of the alveolar chambers, in which it has accumulated as the result of the degeneration of the exudate mentioned above. This is the point of maximum damage to the organ. The greyness is due to various circulatory and degenerative changes which cause anaemia of the part, and to yellowish-grey inflammation products.

4. *Resolution.*—In the fourth stage there is a dramatic change. The repair elements have conquered the destructive elements, and the process of clearing up is proceeding apace. The alveoli are rapidly getting rid of their foreign degenerated fibrin, dead leucocytes, red corpuscles and all the other constituents that have been filling up the spaces for 5 to 10 days. Some of the alveolar contents become dissolved into an easily expectorated solution.

Symptoms.—With the above pictures clearly in her mind, the nurse should be able to follow the course of pneumonia when she is in charge of a case. One lung, usually at the base, is commonly affected, but in 10 per cent of cases double pneumonia may be found, this adding to the seriousness of the outlook. Nurses should remember that as pericarditis and endocarditis always mean involvement of the heart muscle also, so pneumonia is invariably accompanied by a certain degree of pleurisy (inflammation of the pleura) but the converse does not always hold, as we shall find out later.

Anyone who has experience of lobar pneumonia knows that the beginning of the disease is sudden and dramatic. The first sign is pain, usually at the site of the inflamed lobe but often referred to the abdomen, so that appendicitis may be diagnosed. Patients may be seized with the complaint at the office desk or in the factory. The temperature mounts up very quickly, and by the time the patient reaches home there is usually a state of rigor, flushing of the face and an increase of the respiration. By evening the first stage is fully established with the thermometer registering 104° F., more or less, and the pain causing a certain amount of dyspnoea, which, however, is not a

marked feature. As the inflammation develops, the breathing becomes more and more shallow and the rate of respiration goes on increasing with every hour.

By the time the stage of red hepatization is reached, the signs are typical of well established pneumonia. The patient lies in bed on his back, not markedly pained or troubled with breathing, but the respirations are very rapid and one of the main features of pneumonia is prominent, viz. the normal pulse-respiration of 4:1 is completely upset. Thus in a typical case the pulse may be just over 100, while the respirations are about 50 a minute; now and then the respirations are so fast that they can be estimated only with difficulty. One thing should always be remembered about pneumonia. When there is a brisk reaction, with high temperature, pulse of 110 and respirations of 48, and the patient is actively struggling to overcome his trouble it is a much better sign than when the patient is placid, content to lie still, with a temperature of 100, a pulse of 90 and a general air of apathy to life. The cough, which at first is a series of short grunts (as if the patient wishes to bring up sputum but suddenly changes his mind) develops into a more useful reaction and sputum is expectorated.

The sputum of pneumonia is characteristic. After series of crescendo efforts, a thick, tenacious, rather frothy sputum is coughed up, and it is so sticky that often the nurse has to remove its traces from the lips with a square of muslin. In the sputum mug the contents are always of rusty red appearance, almost diagnostic of pneumonia; the type of sputum is easily understood when we refer to the morbid anatomy of the alveolar contents above. At the stage of red hepatization, the doctor is able to determine by examination how the disease is progressing, but the nurse herself, keeping her eyes open, will find much to interest her. The breathing always has a crackling sound and it is very quiet, as if the whole lung were fizzing like a recently opened soda-water bottle. The cause of this is the slowly developing fluidity of the exudate in the lung chambers, thousands of which in action give rise to the typical breathing.

Immediately before the crisis and when the fight seems to be at its maximum intensity the whole aspect of the patient is typical. He is beginning to feel the strain of the struggle and he looks rather anxious, with dilated pupils, somewhat restless head, herpes affecting the region of the face round the mouth and nostrils which dilate widely at each breath. The face is flushed all over and there may be a hectic flush over the cheekbone of the affected side; perspiration is active on the forehead. The urine at this stage shows a great concentration of urates, and probably some albumin, but the characteristic urine of lobar pneumonia shows great diminution of chlorides.

Ultimately when the patience of relatives, of the sufferer himself and even of the zealous nurse is in danger of giving out, the crisis occurs. To those who have stood at the bedside of a pneumonia patient and watched the almost magical effect of the sudden change, more has been conveyed than is possible in any textbook. There comes a time when the grey hepatization undoubtedly begins to clear up and no time is lost in absorption and expectoration of the degenerated exudate. Usually it happens on the 7th day but it may occur earlier or later. The temperature drops quickly to subnormal level, giving the chart the characteristic dip from 104° F. to 97·6° F. in a few hours. The cough becomes easier; more sputum is coughed up and the pulse slows down and beats with more force. The patient sinks into a sound, health-giving sleep, more than necessary after the great fight.

Complications.—Since pneumonia is a general toxaemia, we must be on the look out for certain deviations from the normal course; the "turn" or crisis may not end the acute stage. Instead the temperature may gradually fall over a period of a few days, by lysis, often unaccompanied by any serious symptoms. A false crisis may occur on the 4th or 5th day, but while the thermometer registers subnormal temperature for an hour or two, the pulse remains high and by night the temperature is soaring once more. Again, the stage of grey hepatization may progress towards further purulence, in which there is grave danger not only of gangrene of the lung but of generalized toxaemia from the absorption of pus and organisms from the alveoli. The signs of this unfortunate complication are temperature above 104° F. for a few hours, rigors, then perhaps sudden drop of temperature to less than 98° F., with very rapid pulse, dry brown tongue and sputum which is prune-coloured—a very dangerous state, and frequently terminated by heart failure and death.

In addition to the above dangers, delirium and advanced toxic symptoms may give rise to critical conditions, especially when the patient is addicted to alcohol. The action of the kidneys may fail and when this occurs in persons over 60 years of age the fatal ending may be expected. The respiration and pulse are important indicators. If the former is above 60 and the latter over 120 for any length of time, it is almost certain that collapse is at hand.

Pregnant women commonly have an abortion in pneumonia, while children become affected with acute inflammation of the middle ear, painful joints and occasionally slight meningeal involvement. The pleurisy accompanying pneumonia may end with pus in the pleura (empyema) discussed later, or may result in accumulation of a fluid effusion. Endocarditis and pericarditis may hasten the collapse of an already overburdened heart.

Treatment.—The nursing treatment of lobar pneumonia has undoubtedly been simplified by the introduction of the sulphonamides. The patient, however, still needs expert nursing care such as should be given in any acute infection.

1. *Hygiene.*—The room should be airy and well ventilated, and kept at a temperature of 60° to 65° F. Draughts should be avoided. In suitable weather, nursing in the open air is an excellent arrangement. The bedgown and bedclothes should be light; when the patient's temperature is high a bed cradle may be used to allow of free circulation of air. The position of the patient in bed is determined by his comfort. A semi-recumbent or modified Fowler's position is probably the most suitable, but there is no hard and fast rule.

2. *Nursing.*—The general toilet of the patient should be performed entirely by the nurse in order to eliminate any extra strain on the heart. The patient should receive all necessary nursing attention without any effort on his part. Warm or hot sponging twice daily is necessary while the temperature is high. Attention to pressure points is important, but zeal must not be allowed to run away with discretion, and in the very acute stages all unnecessary turning and disturbance must be avoided. The mouth hygiene must be conscientiously performed as in all cases of acute infections. Infection of the mouth, throat and salivary glands are common when the mouth is neglected. Barley sugar or acid drops given to suck help to keep the mouth clean and are an addition to the glucose intake. Temperature, pulse and respiration are taken and charted every four hours.

3. *Diet.*—Some physicians prefer to give nothing but fluids during the first few days. Others allow milk drinks, eggs, jellies and so on. Whichever regime is adopted the need for copious fluids cannot be too greatly stressed. A daily intake of 5 or 6 pints is not too much, and the patient is usually quite willing to drink as much as is given him. Iced fruit drinks sweetened with glucose are the most acceptable. An adequate fluid intake is especially important in all cases in which sulphonamides are being given. Crystallization of these drugs in the kidney tubules, with consequent suppression of urine can be prevented by copious alkaline fluids (see Section VIII). The diet is gradually increased as convalescence approaches and during convalescence should be as full and nourishing as possible.

4. *Bowels.*—Mild laxatives only may be given. Purging must be avoided. A glycerine enema is much less exhausting for the patient and can be given on alternate days during the first week of the illness.

5. *Urine.*—This should be saved and measured when sulphonamides are being given.

6. *Rest.*—Rest and sleep are imperative. During the initial

stages of the disease morphine is sometimes prescribed. Dover's powder and "Omnopon" are used more frequently because they are less depressant to the heart's action. The barbiturate drugs are useful. Delirium is often a marked feature of the disease in alcoholic subjects and such patients are usually allowed small amounts of brandy or whisky from the time the first symptoms show themselves.

7. *Dyspnoea and Cyanosis.*—These symptoms are relieved by oxygen administration. It is important that whatever method of giving oxygen may be adopted, some form of humidifier is used, since dry oxygen is very irritating to the lungs. The oxygen should be given continuously and not for short ineffective periods, as already stated.

8. *Pain.*—Pain may be relieved by applications of kaolin or linseed. Leeching is sometimes beneficial.

9. *Drugs.*—Sulphonamide therapy should be instituted as soon as possible. It is important to obtain and maintain a high blood concentration for the first few days. Small ineffective doses merely desensitize the patient and do more harm than good. An initial dose of 2 grammes of sulphadiazine or sulphathiazole, followed by 1 gramme 4-hourly day and night usually brings the temperature down in 2 days, after which the dose is gradually reduced. (See also Section VII.)

Some types of organism causing pneumonia may be resistant to the sulphonamides. For these cases penicillin may be of value. Serum has been used with success. The causative organism should be ascertained before using this treatment.

Expectorant cough mixtures are commonly prescribed in the later stages of the disease.

Cardiac stimulants e.g. nikethamide ("Coramine") are prescribed when signs of heart failure are present during any stage of the disease.

Bronchopneumonia.—The fundamental difference between lobar pneumonia and bronchopneumonia is that in the latter the inflammation chiefly affects the terminal bronchioles but spreads to the alveoli, whereas in lobar pneumonia the alveoli alone are affected. In children bronchopneumonia is a serious and common sequel to many infectious diseases, especially measles, whooping cough and influenza, but it may also occur as a primary disease when hygienic conditions are poor, and it is responsible for a high mortality among infants in the slums. At the other end of the scale are the cases which occur in very old people debilitated by senile changes. In many ways the causative factors are similar to those of lobar pneumonia but it is usual to find that bronchopneumonia occurs in waves dependent upon the amount of severe weather experienced. Many cases of severe bronchitis pass on to the stage of bronchopneumonia.

The Condition of the Lungs.—Owing to the sites of the inflammation the distribution of the pneumonia is patchy, but in a severe case it may be very difficult to say whether it is a lobar or a lobular infection, as many adjacent lobules may be affected at one time. The usual exudate is found occupying the alveoli, but it is rather more soft and mucopurulent as compared with the tough fibrinous secretion of the chambers in lobar pneumonia. Another distinction of importance is that in bronchopneumonia, both lungs are affected as a rule. The lung may be likened to a bunch of grapes with half of the latter gone bad. There is no universal lobar inflammation of the air cells.

Symptoms.—A case of bronchopneumonia may begin suddenly like lobar pneumonia, but more frequently the inflammation supervenes on acute bronchitis associated with one of the infectious diseases mentioned above, and it is not an easy matter to say exactly when the inflammation starts, even if the case is under very careful observation. The signs to be on the lookout for are sudden high fever with a good deal of irregular remission of temperature. The cough becomes short and sharp and causes considerable pain. The sputum is not copious nor is there any "rusty" element; it is nearly always swallowed. Sometimes a few streaks of blood may be found. Cyanosis, restlessness amounting to "air hunger," dyspnoea and considerable depression are the rule. The child becomes very exhausted owing to the extraordinary effort of coughing and breathing, and after 1 to 4 weeks, when the condition clears up by lysis, the wasting and debility are serious factors, leading to a prolonged convalescence. Relapses must be looked for in delicate children; they are like barometers when the weather varies. The great danger is the starting of tuberculosis, since the weakened bronchioles and alveoli are ideal sites for the T.B. Many fatal cases are due to general debility, heart failure or blood poisoning. Sometimes there are convulsions.

Treatment.—The treatment of bronchopneumonia is similar to that of lobar pneumonia, except that it is usually of much longer duration. The victim is either very young or very old, so that it is important to avoid any strain on the vitality and to conserve the strength as much as possible. The nurse should aim at providing adequate nourishment. Two-hourly small feeds are given rather than less frequent large ones. Glucose and barley sugar are very valuable as adjuncts to the diet.

Sulphonamides and penicillin may be given in conjunction, as the disease is often caused by a mixed infection. This treatment is determined by the predominant organisms found in the sputum.

Atypical Pneumonia.—It may be mentioned that within the past 10 years much investigation has been made of wide-

spread occurrences of a pneumonia of mild type, with few symptoms, but clear signs pointing to an invasion of the bronchioles. This disease is rarely fatal and is referred to by some as virus pneumonia.

Bronchitis

The branching tubes of the lungs, lined as they are with very delicate mucous membrane and specialized for a highly sensitive function, are frequently the site of acute or chronic inflammation called bronchitis. Climate is above all the determining factor in the occurrence of the disease. The British Isles, with the sea all round them, are notorious for the variability of their weather and the inhabitants have learned to regard the numerous climatic changes as inevitable, preparing themselves for snow in summer or for a winter heat wave.

The bronchi are not so easily adjusted, however, and it is characteristic of Great Britain that bronchitis is one of the commonest ailments known. In fact if careful record were kept, it would be found that few if any of the inhabitants during the course of a long life escape bronchial inflammation in some shape or form. Children, the less robust adults, those past their prime and old people, all run the risk of severe attacks during the trying months of winter, while some suffer from bronchitis all the year round, keeping it under control during the warmer months but allowing it full scope when the colder seasons prevail. It is inevitably a disease caused by the circumstances in which we have to live.

Bronchitis may be studied in its two forms—acute bronchitis and chronic bronchitis.

Acute Bronchitis

Causes.—Normally we all harbour a certain number of organisms in the mouth and throat and they are harmless unless we become debilitated. If, however, we are put to the great strain of adjusting our heat-regulating apparatus to vagaries of climate, our resistance is weakened and these germs may become more virulent on account of the temporary overwork given to our protective cells. On the other hand certain microbes may take refuge in the throat and mouth when colder weather forces them to seek a more congenial environment. In both cases the active germs ultimately reach the bronchial tubes of susceptible persons and begin their activities at once.

The common cold (coryza) may spread to the bronchi, but any infectious condition, causing weakening of the defensive powers, may end in bronchitis. We thus find it as a sequel

to measles, whooping cough, influenza and various other fevers. General diseases such as renal and cardiac defects may also result in this affection. There is a group of irritant chemicals—the fumes of poison gases, as used in warfare, and the dust and vapour laden with minute particles of various harmful materials, of certain industries—which causes a form of bronchitis in those exposed to one or more of its members. It must also be remembered that bronchitis runs in families, some types of individual being more susceptible than others. There is a danger in the extreme Spartan life, just as excessive coddling leads to susceptibility to bronchial weakness. A severe wetting or long standing in damp shoes may create the most suitable atmosphere in the body for the advance of the germs.

Appearance of the Injured Lungs.—The progress of the disease can be traced down the trachea to the larger bronchi, and even to the finer tubes (capillary bronchitis); the last type of bronchitis is serious, as it often goes on to institute a condition of bronchopneumonia, already discussed above. The appearance of a typical bronchitic tube is such as we might expect from a mixed bacterial attack on any mucous membrane. There is increase of the blood supply all over the lining of the tube, giving it a dry, red appearance, devoid of its usual moisture. Later it would be found that the secretion from the walls of the bronchi had become copious, being thickened with pus cells diffused among the mucus. In fully established bronchitis, the tubes are thickened, the channels are almost closed up and everywhere in the tubes is a thick, tenacious, yellowish-green fluid, in which may be found many of the typical ciliated cells shed from the lining membrane of the bronchus.

Symptoms and Signs.—With the above picture in our mind's eye, we cannot fail to appreciate the outward evidences of acute bronchitis. The individual's first sensations are due to the irritation of the delicate lining; probably the whole state of affairs is best summed up in the word, rawness, affecting the upper part of the chest. There is a feeling of tightness and discomfort inside the thorax; breathing demands a certain extra effort. Finally the well known irritating cough of bronchitis begins very insidiously, but gradually increasing in intensity and frequency until it is fully established as an outstanding and most irksome feature, continuing for minutes at a time and suddenly bursting out into spasmodic attacks, resulting in little or no relief for the condition. The depressed and miserable patient, his temperature probably in the neighbourhood of 100° F., seeks his bed through sheer exhaustion. With good treatment, the explosive type of "dry" cough passes off and as the tubular secretion begins to accumulate there is less pain and easier

coughing, the latter accompanied by a frothy yellowish sputum, which increases rapidly until it becomes copious when the cough is said to be "slack." The breathing is loud and embarrassed, owing to the occlusion of the bronchial tubes with thick secretion, but the expectoration of a quantity of sputum after a bout of coughing, which is usually rather demonstrative and raucous, brings temporary relief. Examination by the stethoscope at this stage shows numerous wheezy noises resulting from the bubbling of the air through the fluid in the various sized bronchi.

In the course of a fortnight, the symptoms gradually pass off, and soon the tubes are cleared again, but if the subject is old or of very tender years there is a danger of the extension of the disease to the capillary bronchioles, and as a result of this we may find that capillary bronchitis or bronchopneumonia may supervene, always very dangerous conditions. When this unfortunately happens, the signs of cyanosis, dyspnoea and general constitutional debility are prominent and the patient looks very ill. A fatal termination is quite common. Otherwise acute bronchitis may clear up, break out again, clear up and relapse with the seasons or the vagaries of the weather, until we find that a chronic bronchitis has supervened. This is dealt with below.

The sputum in developed cases of bronchitis is thick and tenacious, slightly frothy and yellowish green, of a depth of colour corresponding to the amount of pus present. In the sputum mug these expectorations form jelly-like masses, somewhat circular in outline and in size about that of a penny. They are full of the various causative organisms. The urine is rather scanty, highly coloured and full of urates.

Treatment.—Acute bronchitis should be nursed by careful adjustment of the temperature of the room. Plenty of fresh air should be admitted, but it should be filtered or screened and the warmth should never be less in degree than 60° F. In many cases patients may go to bed at the start of the trouble and remain for a few days under conditions of ordinary rest, but frequently special inhalation methods, already fully dealt with in Vol. II, Section VI, Chapter 8, may have to be instituted. The bronchitis kettle has brought speedy relief to many exasperated sufferers. The bowels should be kept loose and for the first week a very light milk and fish diet is best. All kinds of drink are very much appreciated; hot fruit drinks, made from fresh oranges, lemons and other citrus fruits are most useful and soothing. The linseed-mustard poultice (see p. 45) relieves the congestion of the chest and causes an increased flow of blood to the part. In milder cases the rubbing in of camphorated oil is beneficial. The chest should be protected by a warm woollen or flannel jacket or by a gamgee jacket. Various cough mixtures

are generally prescribed to soothe the pain or to liberate the secretion, and mixtures which cause increase of perspiration (diaphoretics) are required in the first few days; ipecacuanha in the form of the tincture is the standard remedy for children, as it quickly increases the fluid contents of the bronchial tubes and leads to a condition of free expectoration. When the patient is at the stage of having plenty of sputum to bring up, the process can be urged on by the use of stimulant expectorants, usually consisting of ammonium carbonate, squills, tolu and senega, or of potassium iodide and tincture of camphorated opium (paregoric), employed especially when the terminal stages are reached and a more sedative effect is required to keep the cough from becoming unduly annoying. Penicillin will sometimes shorten the duration of the illness.

Chronic Bronchitis

Prolonged exposure to the climatic conditions already mentioned ultimately results in the establishment of a state of chronic bronchitis. Various kidney troubles, gout and the effects of chronic disease of the mitral valve may also have the effect of producing a state of chronic congestion of the tubes without much preliminary acute phase. A great mass of the more aged of our people keep fairly clear of bronchial congestion during the warmer months of the summer but when autumn appears, they at once develop growing evidences of a return of their winter malady and by the time November has arrived those who are not affluent enough to spend the winter on the Riviera or elsewhere are forced to pass a period of great discomfort in a state of semi-invalidism. Indeed, the high mortality rate among old people in the early days of spring is undoubtedly due to the gradual loss of strength and resistance in the fight against chronic bronchitis which they have had to carry on against odds for the previous 4 or 5 months.

Morbid Anatomy.—The insides of the bronchi show evidences of prolonged inflammation. They may be thickened but as a general rule the lining membrane is reduced to a worn, patchy and generally atrophied layer, in which ulceration is common. The substance of the tubes is wasted and fibrous tissue replaces the muscular elements. There may be a dilatation of the bronchial tubes (bronchiectasis) or of the lung alveoli (emphysema).

Symptoms.—Dyspnoea is the main symptom; cyanosis of the face is present to a certain degree and the eyes are puffy and bloodshot with the efforts of coughing. The attacks of coughing are very alarming to the outsider, as they leave the patient very

exhausted for a few minutes afterwards and there is extreme breathlessness with loud wheezy breathing, irregular and obviously uncomfortable.

The sputum, which is usually copious, varies considerably. Sometimes it is frothy but usually it is rather viscid, free of air bubbles and greenish yellow. Many micro-organisms are present. In some cases, however, the sputum may be very scanty.

Treatment.—All we can aim at is alleviation of a firmly established condition. Warmth, carefully chosen food and a mild climate are of paramount importance. Those who cannot go away from the severities of the winter weather are much handicapped and all that can be done for them is to give palliative drugs such as potassium iodide, ammonium carbonate, ammonium chloride, various balsams, digitalis and strychnine. Cod-liver oil and malt in liberal supply is a good adjunct to the diet, which should otherwise contain plenty of fats, especially butter. The patient should wear thick underclothing, with boots which resist water or damp, and it is often of benefit when the chest is rubbed every morning and every night with liniment of turpentine or with a mixture of lanoline and wintergreen carefully worked into the tissues. The great point about chronic bronchitis is the realization of its periodic variations. The nurse must be prepared for a patient who is in bed for a few days, then up for a week or so, off for a day and then back to the fireside very much upset by the bouts of coughing and the general misery of a chronic bronchitic catarrh. Sleeplessness may be a very trying complication but great care must be exercised in the use of hypnotics. Sometimes hot whisky and water, with lemon and sugar, taken after the patient is warm and comparatively comfortable in bed, will have good effect for an hour or two. Each complication must be dealt with as it occurs.

Bronchiectasis.—This complication of chronic bronchitis may now be discussed. It is little more than an extreme development of the thinning process of the bronchial walls. In many ways it is like the condition of aneurysm, the bronchial tubes widening out into fusiform shapes or becoming sacculated. In the latter case the cause may be contraction of the tissues of a diseased lung, these pulling on the weakened tube from the outside; this is common in advanced phthisis. The symptoms are those that we should expect, viz. a very advanced bronchitis, with the sputum especially peculiar owing to the large cavities formed. In bronchiectasis the expectoration is grossly offensive, having rather a sweet heavy odour, suggestive of the various decomposition gases, acids and other putrid matter contained in it. When left to stand, the sputum divides into 3 distinct layers, the

first being a brownish-yellow, somewhat frothy scum, the second a clear thin layer of mucus and the last a thick layer of pus. During the night the sputum collects in the various sacs, and when the patient awakes he begins to cough up the accumulated secretion of the night. Nurses who have understanding of this performance need not be reminded of its offensive associations; the same procedure is gone through when the patient gets up after lying down or sitting quietly for a period. The foetor of the breath and the diseased general atmosphere of the patient makes him a very miserable being. Several ounces may be coughed up at one time. Cyanosis, wasting, rise of temperature and severe haemorrhages may give many of the aspects of phthisis to the patient, and frequently he dies of toxaemia or haemorrhage itself. The fingers are always characteristically clubbed.

Treatment.—Surgical treatment is often successful when the disease is unilateral. The whole affected lung may be removed (pulmonectomy) or one lobe may be removed (lobectomy). Before surgery is possible, however, a fairly long course of medical treatment is necessary. Ideally the patient should have a room to himself as his condition is so offensive. The general health of the patient is promoted by giving an abundant diet, cod-liver oil and iron. Expectorant mixtures e.g. senega or iodides are prescribed. Creosote capsules help to deodorize the offensive breath. Penicillin may be of value in controlling the sepsis.

Postural drainage is employed 3 times daily in order to clear the offensive material from the distended cavities. The patient lies face downward, turning on to the affected side and leaning over the side of the bed, which is tilted from below to assist drainage; he is then encouraged to cough into a wide mouthed receptacle placed on the floor. This treatment alone makes life much more tolerable for the patient and his friends. It ensures that the lung is freed as far as possible from gross septic material before operation is attempted.

Emphysema.—Although emphysema is a lung and not a bronchitic condition it is so closely associated with chronic bronchitis that it can be discussed at this point. There is always a family tendency to emphysema and it may occur at an early age in children who have had severe whooping cough or asthma or who are especially disposed to the disease. It is very common in those who have had chronic bronchitis for any length of time. The condition is one of ballooning out of the alveoli, which may become so thinned that rupture takes place at the walls of the air chambers, and a series of swellings like blisters is found at the free margins of the lung, this being due to fusion of several alveoli and resultant formation of distended cavities. The chest

tends to become barrel-shaped in order to accommodate the enlarged lungs. The symptoms are almost identical with those of chronic bronchitis, but the dyspnoea and cyanosis are more marked and the cough is very persistent and troublesome without relieving the condition of the patient. In the treatment it is found that a mild seaside climate is best. The greatest care should be taken to prevent chills, which set up bronchitis in increased degree with the result that the emphysematous spaces inevitably become choked and cause great discomfort to the patient. In all cases of chronic bronchitis nurses should assume that there is a certain amount of emphysema. There is a form of traumatic emphysema which is the result of rupture of an air pocket either by forcible coughing or by wound from the outside; in this case the air usually passes into the pleural cavity, with disastrous results. It is a very serious condition. Emphysema may be found round a portion of lung collapsed with disease; this is termed compensatory emphysema. Many cornet players and others professionally employed in playing wind instruments, as well as glassblowers and the like, suffer eventually from emphysema of a mild type. It must be remembered that the analogous condition of bronchiectasis may occur with emphysema.

Pleurisy

Pleurisy is an inflammation of the double membrane which covers the lung with one layer and the internal aspect of the chest wall with the other. The space between the two layers is normally very small, but when inflammation occurs with effusion the lung may be pressed inwards and the space occupied by fluid.

Causes.—In many respects there is a strong resemblance between pleurisy and pericarditis. It may occur as a primary inflammation, in which case it is thought to be almost entirely due to the tuberculosis bacillus; it may supervene on acute lobar pneumonia, blood poisoning of all kinds, infections such as rheumatism and scarlet fever, chronic diseases such as cancer and nephritis and injury. Any lowering condition of the atmosphere, such as wet and foggy weather, may set up pleurisy in a person already weakened by general debility; it may be the expression of the temporary or permanent superiority of certain bacteria which have been lying in wait for the appropriate opportunity to invade the pleural membranes.

The Affected Pleura.—Normally the pleura secretes a sufficient quantity of lubricant to allow the free and easy movement of the lungs in the process of respiration. In pleurisy we

find that the membrane has lost its usual lustre, being red and dry with very little secretion. In farther advanced stages, it is found that irregular flaky deposits of fibrin have occurred on both surfaces of the pleura, giving an appearance not unlike the "bread-and-butter" heart of pericarditis. When the condition ceases to be active at this point, there is a danger of adhesion, the type being known as dry pleurisy, but now and then the two surfaces separate and normal conditions are restored. Dry pleurisy, however, rarely clears up completely; there are always one or two areas at which there is permanent adhesion. Very often the well-known condition of pleurisy with effusion results. The inflamed surfaces ooze with a yellowish fluid, slightly tinged with blood, and the effusion collected in the pleural bag, distending it greatly. The fluid is full of protein matter, fibrin, lymph flakes and occasionally blood, and it has a specific gravity of about 1,015. This fluid may be absorbed, or it may persist and require to be drawn off by aspiration (a very common procedure at which the nurse must be ready to assist). Finally, the fluid may become infected with purulent elements, so that it is transformed into thick offensive pus, giving rise to the condition of empyema.

Symptoms.—With a clear idea of the various stages of pleurisy, the nurse will find that the symptoms are easily understood. The stage of dry pleurisy is carefully distinguished from the stage of pleurisy with effusion. In the former state the onset is indicated by mild attacks of shivering or a general feeling of cold. The temperature may rise abruptly to 102° F. and then appears the symptom which is positive of almost all dry pleurisy; there is a pain with each breath on the affected side which is like the stabbing of a knife or the tearing apart of some closely knit tissues; this pain may be felt as low down as the middle of the abdomen. Every inspiration is reduced to a gasp and this is an ordeal for the patient.

If fluid begins to collect, the symptoms rapidly change. The pain disappears and the patient may actually feel much better for a day or so; careful examination by the doctor, however, will disclose the presence of fluid, and as it increases, the pressure on the lung causes difficulty in breathing, which is usually shallow and increased in frequency. The patient chooses to lie on the affected side, because by doing so he drives the fluid towards the chest wall and allows not only the clear lung to act fully, but also gets the maximum rest of the lung which is the site of the pleurisy. There is a sense of restless discomfort; the cough, which at the beginning was almost impossible, is now more hacking in type and it is shortened by the constricting fluid. Some clear sputum is brought up; this is typical of pleurisy, there being no blood or pus cells present. The

physician, by placing his hand over the affected area, can feel the friction of the two surfaces when the fluid has not gathered to any extent. Later he determines by percussion and auscultation that a bag of fluid surrounds the lung. After the fluid has accumulated to a serious degree the symptoms are very distressing, since there is pressure inwards, affecting the heart and even displacing it, and pressure downwards on the stout diaphragm, causing great discomfort and restlessness owing to the tension on the liver and other organs. We can use the x-rays to show how far the dislocation has progressed. The picture obtained may show partial collapse of the lung on the affected side, displacement of the heart and dislocation of the liver; it gives a clear outline of the effusion.

There are 3 possibilities in pleurisy. Assuming that the fever has persisted for more than a week and that there is no evidence of the simple clearing up of a dry pleurisy we find that the following alternatives face us.

1. Simply pleurisy with effusion, accompanied by variable low fever for a week or two, with gradual absorption of the fluid and possibly some residual areas of permanent adhesion.

2. Persistent effusion which after a certain point becomes stable in amount and requires to be aspirated from the chest.

3. The complication of empyema, which is a serious condition, the lung being surrounded by a bag of pus. This is a surgical disease and is fully described later (see Vol. IV, Section X). It is indicated usually by swinging temperature, the occurrence of rigors, profuse sweating at night and above all by a great increase of the leucocytes in the blood. Confirmation is completed when the surgeon draws off a small sample of the fluid.

Treatment.—With regard to the non-empyema cases, we find that we must first make our plans on the assumption that absorption is going to take place. In the dry type all that is required is rest, with a sedative for the pain and counter-irritation by mustard plaster, by blistering or by one of the methods described on pp. 44–47. When fluid has accumulated, all efforts should be made to remove it by conservative methods, and the sooner even a small amount of fluid is discovered and dealt with the better for the patient. Thus it is usual to start vigorous treatment by painting the affected side of the chest with strong iodine liniment, or by applying blisters or by application of a few leeches. Many authorities advocate the giving of a heaped tablespoonful of magnesium sulphate in 2 oz. of warm water first thing in the morning—an excellent and very scientific remedy for hospital patients, but distinctly subversive to the popularity of the doctor and of the nurse so far as private patients are concerned. The purging sometimes does more harm than good.

Suppose, however, that despite all these efforts the fluid refuses to clear up, and the examination shows a stationary amount of effusion in the pleura. There is only one remedy—aspiration. This may be done by ordinary trocar and cannula or by Potain's aspirator (see pp. 51–54). Occasionally, the operation has to be done twice or three times, as it may be inadvisable to remove the pressure from the organs too suddenly, or alternatively, the fluid may accumulate slightly. Once the pleura is clear the nurse's work is not done. She must do all she can to obtain full re-expansion of the lungs by ensuring that the patient does simple deep breathing exercises several times a day, and that forcible expansion is brought about by blowing into special blow-bottles. In some cases, the examination of the fluid shows that blood is present, or certain cells indicative of tuberculosis. Such conditions require special forms of treatment described elsewhere. In the convalescent stages of pleurisy with effusion the patient should be stimulated by iron and strychnine tonics; rich nourishing food, with cod-liver oil and malt, should be given in an attempt to restore the tone of the whole body.

Phthisis

Phthisis is popularly known as consumption and refers especially to tuberculosis as it affects the glands, bronchial tree and lung tissues, but as it is better considered as part of the infectious diseases, it is dealt with under the heading of Tuberculosis (pp. 419–425) to which the nurse is referred.

Asthma

Asthma is properly a symptom of a general state of sensitivity (allergy) to some protein element in the patient's environment and may result from the inhalation of particles in the air or from the eating of certain foods. Perhaps it would be better to regard asthma not as a true disease, but rather as the outward evidence of a human constitution that deviates from normal type in that the protoplasm is not so stable as that of non-asthmatics and tends to obstruct the natural and usual simple methods of nourishment and repair. Together with asthma, many well known phenomena exist in other organs, but with the fixed principles of a sensitivity or anaphylactic basis as the fundamental factor in our minds, these occurrences can be explained and to a certain extent understood. The nurse will find that she may be baffled by asthma, as every practising member of the medical profession has been, and it will be to her advantage in her daily round if she is able to grasp the main points of the modern theory, which her asthmatic patients, ever ready for knowledge, will also be keen to discuss since they continually look for a cure.

Causes.—That asthma is "in the blood" must be accepted, but now and then a generation is skipped or it may be that the missed generation has representatives who do not show marked evidences of protein sensitivity. For instance nettlerash (urticaria), eczema and other skin diseases, migraine, epilepsy and other allergic manifestations may all be discovered as part of an asthmatic diathesis in those who have never had a wheeze in their lives. There are thus "asthmatic people" who are mentally and physically distinguished from their fellows by certain peculiarities which to the trained eye are unmistakable. They are constantly trying to adjust themselves to the easier standards of the normal existence, whatever that may be; the struggle that is going on is shown in one of the so-called diseases mentioned above, the most dramatic and impressive of which is asthma. There is no doubt that the mental influence is very strong, and this may explain why some asthmatics are free of trouble in one place but very much upset in another without reference to climate or food, and why emotional factors play so big a part in the asthmatic's life.

Small local defects may be the irritating foci of an attack. Nasal polypus, congestion of the liver, the presence of a group of micro-organisms are simple examples of the "triggers" that fire the gun. Asthma may begin in childhood, in which case it is most likely that the child has become sensitized to some article of food e.g. cow's milk, in his very early days. Measles, whooping-cough and other children's complaints seem to put the necessary strain on the system that allows the asthmatic tendency to be displayed.

So far as the nurse is concerned the hundred-and-one theories of asthma do not count. It is sufficient for her to know that an asthmatical attack may be set up by the circulation of certain pollens in the air, by the scales of dandruff shed by animals such as the horse or the cat and by the eating of proteins in specific foodstuffs, these invariably leading to asthma. The degree of refinement in these proteins is of the greatest importance in the precipitation of an attack. For instance the protein of the flesh of the calf (veal) may be quite easily tolerated, while the flesh of the adult ox (beef) may set up acute asthma. For this reason the nurse must be prepared to study her patient—especially in the aspects of his dietary—very closely indeed.

Symptoms.—The effect of the slightest overdose of intolerable protein is to cause reactions such as we have mentioned above, but particularly in the case of asthma, spasm of the finer bronchi, swelling of the mucous membrane with mucus, some mild inflammatory reactions in the blood vessels—in short a condition in which the branches of the bronchial tree are universally choked. This has the inevitable effect of producing dyspnoea of

a spasmodic type, the attack coming on suddenly and dependent upon the presence of the irritating factor, whether it be the smell of a stable, the stuffing of a feather bed or the eating of curried prawns. Men are more susceptible than women, which may be associated with their somewhat lower state of physical and mental refinement. There is no doubt at all that asthmatic attacks have a short preliminary warning stage, in which most of the symptoms point to liver congestion. Starting from this, many investigators regard asthma as a state secondary to fall of the first line of defence in the liver and they succeed very well indeed in aborting attacks by relieving the congestion. The actual asthma often begins during the night; this is thought to have some connexion with the metabolism and the acid tide, the bodily activity being at its lowest at that time. The attacks may last for an hour or a week; there is no disease which baffles description on accurate lines so greatly as asthma. An asthmatic learns to anticipate when he will be free from attack and when he will be laid low, and the nurse has to be guided greatly by his peculiar attitudes to many of the normal things of life.

The chronic asthmatic has a hollow chest, rather long neck and sloping shoulders; his face is dusky and he has the anxious eye of the man who expects to have a struggle for breath at any moment. Leanness is a feature; fat people who say they have " asthma " will probably be found to have bronchitis. During the attack, the signs of asthma are alarming owing to the difficulty experienced by the patient in emptying his lungs, all sorts of attitudes being adopted and every kind of remedy sought. But the nurse need have no fear; death in an asthmatic spasm is very rare, and she can have every confidence in telling anxious onlookers that once the spasm is over the patient will be quite fit for most of the activities of his life. The wheezing is very loud, prolonged and noisy, and small spherical expectorations like thick jelly are coughed up; these contain spiral threads of mucus. During the attack the cyanosis may approach at periods the nearest state to the popular " black in the face." It is a very terrifying demonstration, but the individual quickly readjusts himself to his environment when the spasm is over. The neurotic element of asthma has been blamed for many of the symptoms but it is obvious that there is a great deal more than neurosis to account for the signs although emotional factors often determine the onset of an attack. Hay fever should be regarded as closely allied to asthma.

Preventive treatment of asthma is most important and this is both physical and psychological in action. A child who suffers from this disability often does much better in an environment in which there is freedom from anxiety about his condition. Anxious parents provide an atmosphere in which asthma will flourish.

If the child can be sent away to school or to some sensible friends the number and severity of the attacks are often remarkably lessened and sometimes cease entirely. Unless there is a rise of temperature and bronchitis is present, normal activities should be encouraged as far as possible, although excitement must be avoided. Special exercises can be practised to learn how to correct breathing and posture. The Asthma Research Council has done most helpful work on this subject. No child should be allowed to develop an attack of asthma if it can be avoided. There are various antispasmodics which can be given regularly each night before bedtime, if necessary. This does much to prevent the habit of asthma.

Hygiene of the nose is important. Any septic foci such as are associated with adenoids and tonsils should be dealt with. The child should be taught to blow his nose well and regularly, especially before sleep. This not only gets rid of excess mucus, but also eliminates dust and pollen to which he may be sensitive.

Skin tests are sometimes performed to ascertain to which proteins the child is sensitive, and thereafter effort is made to avoid contact with these. This, however, is difficult and often impossible and leads to increased fussiness and anxiety. Indulgence in any form of food proved to produce spasm should be forbidden.

If the asthma habit can be broken there is hope that the child will overcome his disability and grow up strong and healthy.

An actual attack of asthma in either the child or adult is best aborted by the hypodermic injection of adrenalin 1–1000 (2 to 5 minims) which may have to be repeated. Other remedies are ephedrine (½–2 grains) which is given by mouth, and stramonium, which is inhaled. The most recently discovered remedies ("Benadryl," "Antistin," etc., are described on pp. 136 and 140.

Diseases of the Larynx and Trachea

Apart from the infectious diseases which are discussed elsewhere, there are one or two common diseases of the larynx

FIG. 62.—LARYNGEAL MIRROR.
(By courtesy of the Surgical Manufacturing Co., Ltd., London.)

likely to be met with by the nurse in the ordinary course of her work. In addition, some knowledge must be gained of a few of the rarer diseases of the upper respiratory tract. Examination of the larynx may be made by using the laryngoscope (an instrument

provided with an electric lamp and mirror, so placed at the back of the pharynx that the larynx is visible to the observer) or by the reflecting mirror as illustrated. The interior of the throat may be illuminated by the headlamp illustrated in Vol. II, p. 381.

Acute Catarrhal Laryngitis.—Various causes may be responsible for this condition, which is one very similar in type to the state of bronchitis lower down. Steady breathing of irritating gases, scalding by hot drinks, the influence of fog and spread of coryza—the common cold—from the pharynx may be responsible. Examination shows the vocal cords to be red and swollen, this causing a tight sensation in the larynx and a very irritating cough of high pitch. The voice is very hoarse. The treatment consists of rest in bed for a day or two and absolute rest of the voice. The sucking of glycerine pastilles is of great benefit, but most relief is obtained by the inhalation of the fumes which arise from a solution of one tablespoonful of friars' balsam in a pint of boiling water, or by any of the other methods mentioned in Vol. II, pp. 345–349.

False Croup.—This is a spasmodic form of acute laryngitis, known as laryngitis stridulosa. It occurs in children of from 2 to 5 years of age and almost invariably happens during the night, when the child, who is slightly fevered, is awakened, as well as the rest of the household, by a sudden high pitched coughing and very loud crowing type of breathing. The face may become livid after the cough has gone on for a little, and the doctor is hurriedly sent for only to find on arrival that the child is sound asleep, the attack having passed off as quickly as it came. It may occur for a night or two following in exactly the same way, but it leaves little or no after-effects. Poulticing of the neck or the application of hot stupes may be efficacious; a mustard bath is sometimes necessary. It is difficult to give a child inhalations in a working-class home. Very often the attack is over before a plan of action has been decided upon. During the next few days it is well to ensure that the bowels are loose, that all excitement is prevented and that a small dose of bromide of potassium is given at bedtime.

Chronic Laryngitis.—While certain irritating factors in the nose and throat may result in chronic laryngitis, it is found in those who use the vocal cords to excess (" clergyman's sore throat "), and is therefore associated with actors, public speakers, newsboys and others who live raucous lives. The presence of tuberculous laryngitis or of cancer of the larynx must first be disproved by careful examination. A similar condition results from excessive cigarette smoking and with over-indulgence in alcohol. The vocal cords are usually congested and thickened and somewhat grey. There is a constant desire to " hawk and hem," and

a certain amount of thick phlegm is coughed up. The hoarseness depends upon the time of day. In the morning it is not so marked and the voice is moderately strong; as the time goes on the voice gradually fades into a hoarse whisper. The treatment is removal of the cause, whatever it may be, and the insistence on a " dumb " period, during which all talking is absolutely forbidden. Various inhalations, sprays and other local applications have a very transient effect. The main essential is the rest to the cords and the taking of a tonic.

Laryngismus Stridulus.—Popularly known as " child crowing," this is a disease of infants, associated generally with rickets, general debility, tetany, the asthmatic tendency and enlarged tonsils. The exciting factor is a fright, excess of excitement, a heavy supper, usually with unsuitable food, and teething. As with false croup, the patient is suddenly wakened with an attack of acute dyspnoea, and his parents discover him to be suffering from extreme lividity and cyanosis. The larynx is in acute spasm. In a few seconds the spasm passes off, the expired air rushing past the vocal cords and producing a typical crowing noise. These attacks may go on at odd times for several days and may be associated with spasms of the hands and feet (tetany). None of the signs of diphtheria is present, but mothers always have a fear of this, so doctors usually swab the throat and have the smear examined. The treatment in the acute stage may be that of convulsions, viz. putting the child in a hot bath while he is constantly sponged with cold water, but sometimes a cure is speedily brought about by squeezing cold water over the child's face and causing him to cry, which solves the problem immediately. Very rarely, chloroform is necessary. The general health should be improved by anti-rachitic treatment, fresh air and better hygienic routine. This is the disease popularly referred to as " croup " by the layman.

Tracheitis.—In the common cold, tracheitis may result from extension of the bacterial field of invasion; it may also represent a type of highly situated bronchitis, which it very much resembles. The symptoms are a burning pain in the chest, with irritating cough, quickly relieved when the secretion begins to flow and expectoration is profuse. Treatment is similar to that of bronchitis.

Oedema Glottidis.—In certain local septic conditions of the neck in the region of the larynx, and also as a sequel of infectious diseases, including tuberculosis and syphilis, the tissues of the glottis may become so much swollen that the patient is in danger of being choked. Death sometimes occurs very rapidly, but usually there are all the signs of obstruction of the larynx, which

must be vigorously dealt with by ice poultices, leeching or even incisions to let out the fluid.

Cancer of the Larynx.—Although the smallest growth may be present on the cords, there is a rapid spread, with ulceration, and soon there is haemorrhage and severe necrosis. Pain accompanies the symptoms of loss of voice, hoarseness and difficulty in swallowing. Operative measures are unsatisfactory; radium is likely to provide the solution in the course of time.

Other Diseases of the Lungs and Pleura

Congestion.—Congestion may occur in two ways, actively and passively. Active congestion is simply the first stage of any inflammatory condition. Passive congestion may be due to the pressure of large tumours or to long established disease of the mitral valve which causes a hold up of the blood returning from the lungs to the left atrium. All the blood vessels become congested and bleeding takes place into the alveoli, resulting in signs of chronic bronchitis, with haemoptysis, a condition typical of advanced mitral disease.

Hypostatic congestion is associated with a feeble heart doing its work unsatisfactorily in conditions such as chronic debility, the coma of cerebral haemorrhage, fracture of the femur in old people and in cases in which the patient is confined to bed for a long time. The bases of the lungs may become so much engorged that the condition of hypostatic pneumonia is threatened, always a possibility in the numerous cases of severe illness which necessitate a lengthy period in bed. In some cases bleeding is resorted to, otherwise the usual methods of dealing with the heart weakness or the general debility are adopted. Nurses should remember that it is better to prevent this type of congestion than to undertake its cure, if such be possible. Occasionally a similar condition of oedema of the lung may be found, especially when the kidneys are not acting efficiently. The lungs are waterlogged and swollen. This demands general as well as local treatment. In some types dry cupping or venesection brings relief but the condition may be expected to disappear rapidly if the urine is increased in amount.

Infarction of the Lung.—When an embolus, detached from a cardiac valve, becomes stuck in the lumen of a pulmonary vessel the wedge-shaped territory fed by the latter becomes degenerated and in the course of time completely fibrosed. The same condition may be caused by a small clot, formed in a vein or in the right atrium, which travels to the lungs. As a rule several of these can be seen as lighter patches the size of a halfpenny on the surface of the lung, usually at the base. The

symptoms are sudden severe pain with coughing and spitting of blood. When a large artery is blocked, death may occur at once. The best way to treat such cases is to insist on complete rest. The general treatment of haemoptysis should be carried out.

Collapse of the Lung.—The lung may collapse in various ways. First it may never expand at all, being like a knot at birth and remaining so (atelectasis). Air in the pleura (pneumothorax), or effusion from the pleura, may cause such pressure that the lung on the affected side may collapse completely. Much the same condition is produced by penetrating wounds of the chest or by a paralysed diaphragm. Finally there may be collapse of a lobe or of several scattered lobes, by collections of mucus actually forming plugs in the bronchioles. The condition is often found in bronchopneumonia. The symptoms are usually great dyspnoea, cyanosis and increased pulse rate until the sound lung is able to develop a compensatory increase of activity. Collapse must be regarded as a serious complication of any pulmonary disease; it is treated by measures appropriate to the conditions.

Fibroid Phthisis.—This is not associated necessarily with tuberculosis, although it may result from it. The fibrous tissue of the lung is increased at the expense of the air cells, which degenerate, the bronchioles and blood vessels also being involved. It results from phthisis, pneumonia (chiefly lobular) and chronic pleurisy and from pressure on a bronchial tube by aneurysm or tumour. Bronchiectasis is a well known complication. The treatment is that of alleviating the cough and dyspnoea, together with relief of as much of the cardiac pressure as may be possible. In massive fibrosis (chronic interstitial pneumonia) the affected side of the chest may be immobile and flat.

Trade Lung, also called pneumonokoniosis, is the result of constant inhalation of certain types of dust, and is associated with miners, who suffer from anthracosis and silicosis, the latter also affecting masons and all those who work at grinding and with steelworkers, who inhale fine iron salts (siderosis). To begin with there are irritative symptoms, but gradually fibrosis sets in and tuberculosis is common. These troubles are most important from the point of view of industrial medicine and the hygiene of the worker.

Tumours.—Cancer is not common as a primary disease, but secondary growth may be found in the lung, spreading from glands and from the liver. In addition to the usual cough, breathlessness and pain, there is a characteristic sputum, which resembles red currant jelly. A fatal result may be expected a few months after discovery; surgery occasionally succeeds.

Abscess of the Lung.—This may follow septic conditions in the throat, nose, tongue, in which case the germs are aspirated during inspiration, or it may be the result of spread of the sepsis from neighbouring organs such as the liver or the chest wall. The signs of septicaemia or pyaemia are marked; the temperature swings, the pulse is rapid, and the sputum is very septic. Such conditions are usually fatal but incision and drainage may save the patient's life.

Gangrene of the Lung.—Gangrene may affect the whole or part of a lung. It is a very dangerous condition and accompanied by offensive breath and a sputum which, like that of bronchiectasis, divides into 3 layers. Sudden collapse and death are common.

Pneumothorax.—An abnormal amount of air in the pleural cavity gives rise to this condition, which may be caused by injury of the chest wall, allowing the outside air to enter the pleural space. Air may also get to the pleural space by the breaking down of a tuberculous area, which ulcerates through the visceral layer of the lung, and air is thus sucked through from the supplying bronchus. We have also found that forcible rupture of a swollen emphysematous chamber may cause a similar air-connexion. Lastly the pus of empyema, of abscess of the lung or of the degeneration of gangrene may break into the pleural space The hole may be of varying sizes and sometimes it closes up quickly, but commonly it remains open for some time. The symptoms are well known, and should be recognized by the nurse. There is usually great pain, with rapid collapse, a rapid, small pulse and quick shallow breathing; the patient has great difficulty in getting breath. The treatment is that of the shock, but morphine may be required for the pain. In some cases the air may be allowed to escape by the making of an incision.

[Nurses should note that artificial pneumothorax, one of the most successful methods of treatment for phthisis, has no connexion with the above. It is referred to later (see pp. 424 and 425).]

Haemoptysis.—Bleeding from the lung is a symptom, but it may occur in the following diseases, and it is advisable that the nurse should be able to review in her mind rapidly the probabilities of the case.

1. *Phthisis:* streaky and bright red. Copious and frothy when a large vessel is ruptured.
2. *Pneumonia:* rusty.
3. *Cancer:* like red currant jelly.
4. *Abscess, gangrene, bronchiectasis:* the other constituents of the sputum are typical.
5. *Advanced cancer of the larynx:* the blood may be in small clots at irregular intervals.

6. *Arteriosclerosis:* chiefly in the aged; spasmodic and not copious.

7. *Mitral disease:* indication of severe mitral insufficiency and of great pulmonary congestion; may be steady and of fair amount. Very serious.

8. *Pulmonary embolism:* similar to above.

9. *Minor causes:* excessive smoking, forcible clearing of the throat, or coughing; purpura and other similar blood diseases

In all cases of haemoptysis, the nurse should make sure that there has been no adventitious supply of blood to the sputum. Cases have been known in which hysterical ladies and malingering men have pricked their fingers with a piece of glass and made a simple catarrh into a suspected tuberculosis.

Treatment.—If bleeding be severe the patient is put to bed with the shoulders raised slightly by means of a pillow and the head tilted back. This prevents to some extent the spread of blood through the lung. Sometimes the patient is able to say from which side the blood is coming, in which case he lies toward that side. He should be kept at complete rest and all nursing procedures performed for him with the minimum disturbance. According to the severity of the haemorrhage he may be required to be kept quiet for several days or even weeks.

Morphine is usually ordered to allay anxiety and prevent coughing, thus giving the blood time to clot. Ice may be given to suck. Some physicians order an ice bag for application to the chest, but if there is much shock this is not good treatment.

Diet should be fluid or very light at first and gradually increased as the condition improves.

CHAPTER 4

DISEASES OF THE ORGANS OF DIGESTION

GENERAL SYMPTOMS. APPETITE. NAUSEA. VOMITING. CHARACTER OF VOMIT. ABDOMINAL PAIN. STATE OF BOWELS. CHARACTER OF STOOLS. JAUNDICE. DISEASES OF SPECIAL ORGANS OR REGIONS. DISEASES OF THE MOUTH. STOMATITIS. PYORRHOEA. DENTAL CARIES. DISEASES OF THE STOMACH. DYSPEPSIA. GASTRITIS. PEPTIC ULCER. DIAGNOSIS. TREATMENT. COMPLICATIONS. DISEASES OF THE INTESTINES. ENTERITIS. ULCERATIVE ENTERITIS. ULCERATIVE COLITIS. MUCOUS COLITIS. DISEASES OF THE LIVER AND GALL BLADDER. CIRRHOSIS. HEPATIC ABSCESS. OTHER CONDITIONS. DISEASES OF THE PANCREAS.

MOST of the diseases of the alimentary system show symptoms and signs having some relation to the taking of food. As a general rule a defect of the stomach induces a reaction which aims at the refusal of food altogether or which rejects the food not long after it has been swallowed. After the food has passed through the pylorus it must travel about 26 feet in 30 hours or more; there are therefore sets of symptoms variable according to the part of the tract involved, depending upon the nature of the food and associated with the period of time which has elapsed after the food has been swallowed. Most of the signs of intestinal disease are the result of irritation of the fine lining mucous membrane. Pain, reflex nausea and diarrhoea are therefore to be looked for, but there are many other accompanying symptoms. which help to complete the clinical picture of each disease. The chief general symptoms of alimentary disease are as follows.

General Symptoms

Appetite.—Appetite may be regarded as the message from the part of the signalling machine of the body specialized particularly for the prompt replacement of used fuel. Appetite varies with the individual. Very often the word is misused, especially when it is applied to the gluttonous engorgement of the stomach of the man who lives to eat and does not eat to live. A good healthy appetite is one which makes insistent demands for food

when several hours have elapsed since the last meal was taken, when vigorous work has been done and when the tissue energy is in need of further power. In such cases the taking of a normally constituted meal is quite sufficient, and the eater of it leaves the table satisfied and replenished for the next spell of work but in no way hampered by overloading of the stomach or by ingestion of the wrong type of food. Many gastric troubles arise from the deliberate gluttony of the affluent idler; a certain proportion are due to hasty eating, to improper mastication and to the nervous, highly strung life of modern days. The appetite may be quite good in such cases, but the fuel is delivered in an " unsorted " state, like mixed coal. If the general bodily welfare be up to the standard, if there is a healthy condition of the stomach wall and if the individual has the satisfaction of knowing that he or she has done a good morning's work, the sensations conveyed by the nerves of the mouth to the salivary glands cause increased flow of saliva, and the individual finds himself in a condition ideal for the eating of a meal. All loss of appetite is due either to disease of the alimentary or other systems, or to mental influences which do not allow the sensations of hunger to develop. The name, anorexia, is usually given to serious loss of appetite, which may be found in severe gastric inflammation, in cancer, in many debilitating constitutional diseases such as tuberculosis and in nearly all acute febrile troubles. In cases of nervous debility in which the mind dominates the situation and the whole of the reflex stimulations may be interfered with by the powerful influences at work in the brain, there is loss of appetite—one of the chief signs of excitement, fear, grief, worry and depression, and striking at the fundamental root of good health. The medical profession, recognizing this, has within recent years come to the conclusion that the mind and body interact much more closely than was formerly thought; the term, psychosomatic disease is used, as its name implies, to describe conditions in which the symptoms and signs are set up in an organic pattern, the result of strong mental influence of pathological character.

To a certain extent alcohol is good for the tissues, but the taking of mixtures of gin, vermouth, brandy and other stimulants in order to make food palatable can have nothing but disaster associated with it in the long run. Fortunately the craze for cocktails has been dealt with by the politicians and there is a better outlook for the stomachs of the future generations. Excessive appetite may be an evidence of diabetes or of hyperthyroidism; it is a sign that the fire is burning too briskly, of a demand for more of something that is urgently required by the tissues. Many children who suffer from threadworms have a huge appetite, but it does not do them any good: they remain thin and weary looking. Excessive thirst is found in diabetes,

and also in severe diarrhoea, since in both cases there is a demand for more fluid in the tissues. Perverted appetite is very common in mental disease, and sometimes a normal pregnancy is complicated when the patient takes a fancy for great quantities of, say, rice or even of charcoal.

Nausea.—Nausea is usually ended by vomiting; it is the advance guard which gives warning to the patient and to his neighbours. But in certain cases nausea is not accompanied by vomiting and then it is a very serious and uncomfortable condition, developing in intensity until it is undeniably a menace to health. In a mild way nausea is demonstrated by the bad taste in the mouth common in dyspepsia and hepatic congestion, and, as mentioned above, is a bulwark against further strain likely to be caused by the ingestion of fresh food. The nausea of seasickness, of certain nervous ailments, and of suppurative conditions of the mouth, such as pyorrhoea, is something clearly upsetting and disappears only when the cause is removed.

Vomiting.—Vomiting is the voluntary or involuntary act of evacuation of the stomach contents and it may result from the mechanical stimulation of the nerves at the posterior part of the palate or of the diaphragm muscle; it may also be induced by the presence in the stomach of a mass of improper food, i.e. relative to the functional condition of the stomach and intestines. In some instance vomiting occurs without preliminary nausea, especially in cases of brain disease or mental defect; examples are to be found in cerebral tumour or inflammation, and in most neurotic states and in the gastric crises of locomotor ataxia.

Physiology of Vomiting.—When nausea produces a reaction of the stomach, diaphragm and abdominal muscles in an endeavour to evacuate something from the stomach, but without actual vomiting, we call the process one of retching; it is very common in many nervous states but especially when the patient has reached such a stage of sickness that he has induced a regular series of retching fits. These may be very weakening in serious ailments and they must be checked as soon as possible. To understand fully the process of nausea and vomiting, we must appreciate that there exists in the medulla of the brain a special centre (the vomiting centre). Messages may pass to this receiving station by the various nerves involved. Thus in tickling the pharynx with a feather, we stimulate the sensory fibres of the trigeminal (V cranial) nerve, or of the glossopharyngeal (IX cranial) nerve, and immediately there is a response in the medullary centre, which travels as a motor impulse along the vagus nerve, the phrenic nerve and others, to the stomach, diaphragm, abdominal muscles and others connected with the act of expulsion of the gastric contents. In addition to the sensory stimula-

tion from the throat, there are afferent impulses which may travel from the stomach itself (through the vagus nerve) and from the peritoneum, kidney, liver, uterus, testis, intestines and other abdominal organs. The special senses of smell, taste and sight may result in a vomiting reflex, provided the stimulus is great enough. " I turned sick at the very thought of it," is a common everyday expression. Finally the medullary centre may be influenced not by afferent nerves but directly through the medium of the blood stream. This is common in cases of vomiting after anaesthesia, in cases of tumours and abscesses of the brain, in uraemia and in the toxaemias associated with acute fevers.

The Act of Vomiting.—Vomiting is not so simple as it looks. Three stages are usually defined, the first being nausea accompanied by watering of the mouth, the second being a sensation of great distress with increased respiration and the third being sharp closure of the glottis, followed immediately by spasm of the diaphragm, abdominal muscles and the stomach itself, and finally the ejection of the stomach contents. The reaction has widespread effects, including great increase of all secretions. For example the bronchi exude much fluid, which is immediately coughed up; tears run from the eyes, the saliva flows from the mouth and sweating is profuse. These are all of benefit to the patient because they help to get rid of harmful substances from the blood and make way for the addition of fresh water.

Causes of Vomiting.—We can now sum up the causes of vomiting under various headings as follows.

1. *Diseases of the Stomach* (Note that in this group there is always some association with food and often nausea and pain, both relieved by vomiting). Ulcer, cancer, acute dyspepsia, gastritis, lack of gastic tone, pyloric obstruction, effect of emetics.

2. *Diseases or Disorders of the Intestines and their Associated Glands.*—Ulceration, peritonitis, appendicitis, gallstones, various forms of intestinal obstruction, constipation, diarrhoea.

3. *Nervous Derangements* as mentioned above.

4. *Other Causes.*—Early pregnancy (morning sickness); renal calculus; nephritis; injury to sexual organs; poisons; the onset of fevers, especially scarlet fever.

Character of Vomit.—A great deal of useful information may be obtained by examination of the vomitus. The nurse should not be content with the presentation of a specimen for the doctor's inspection; she should be able to describe when the vomiting took place; whether it was sudden and precipitate; or prolonged and partial; how it affected the patient; whether it was preceded by nausea, retching or pain. Sudden vomiting always occurs at the beginning of fevers, in appendicitis and especially when a poison has been taken, whether it be in the form of

tainted food, excess of alcohol or overdose of a drug. In babies the projectile vomiting associated with pyloric obstruction (congenital pyloric stenosis) is absolutely typical. The occurrence of vomiting in relation to food should be noted particularly. Vomiting before breakfast should lead to suspicion of pregnancy in females or to a diagnosis of chronic alcoholism or kidney inflammation in both sexes. Vomiting which occurs about half an hour after a meal should point to peptic ulcer, but if food is rejected immediately after it has been taken, the act should lead us to suspect liver congestion, dyspepsia, severe toxic poisoning of some sort or hysteria. It is one of the simplest things in the world to induce a habit of vomiting in those of neurotic tendency. When vomiting occurs at odd times it is a likely sign of brain abscess or tumour, locomotor ataxia or a stomach muscle which has lost so much tone that the stomach is like a flabby bag.

Examination of the Vomitus.—First the general characters must be noted. Is there much or little fluid? What is the state of the solid matter? Is there an offensive smell? The colour and reaction to litmus paper should be noted.

In an abnormal specimen there may be found excess of bile, in which case the vomitus is yellow or greenish yellow. Haematemesis is one of the most important pathological signs known since it usually indicates the presence of peptic ulcer and is characterized by a vomitus which is classically described as the "coffee-grounds" vomit, owing to the fact that the blood is clotted and partly digested by the gastric juice before it reaches the mouth. In many cases blood from a duodenal ulcer leaks through the pylorus and is vomited in a similar condition, the fluid being dark brown, acid and frothy and mixed with small pieces of food and mucus from the stomach. Now and then in massive haemorrhages of the stomach, the result of rupture of moderately sized vessels (e.g. in long-standing liver congestion or in large ulcers), or of wounds, erosion of the stomach wall or of the gullet by massive aneurysm, the vomitus is bright red, and must be carefully distinguished, usually by the presence of small particles of food, from haemoptysis. We must also eliminate the possibilities of blood swallowed from the nose, the tonsils or the socket of a tooth. In all cases of true haematemesis there is some degree of melaena—the passage of black stools resulting from alteration of the iron pigment of the blood.

If the vomitus is offensive and actually faecal, it is usually a sign of intestinal obstruction. Such appearances always are found after two or three acts of vomiting in which the usual stomach contents are brought up. Faecal vomiting is a sign of danger; the vomitus is like brown soup and most offensive to the nose. It is found in strangulated hernia, intussusception and other obstructive conditions of the bowel, and demands urgent

operation on the abdomen. Offensive vomit is also characteristic of advanced carcinoma of the stomach.

Treatment.—Since vomiting is a symptom, the cause of the vomiting must be investigated. For instance it is useless only to wash out the stomach when there is renal colic. Palliative measures consist of rest, quietude, giving of small quantities of brandy and soda, application of hot fomentations or ice poultices to the epigastric region. In many cases vomiting cures itself; the acts go on until the irritative factor is completely discharged.

Abdominal Pain.—Pain in disease of the alimentary system is usually confined to the area of the affected organ but it must not be forgotten that the phenomenon of referred pain is demonstrable in many diseases of the abdominal organs. In some cases, e.g. in gallbladder affections, the pain is referred to the shoulder. The chief types of pain likely to be experienced are given below.

1. *Heartburn.*—The origin of this term dates back to the time when the sensation of " burning over the heart " was not understood. Now we know that it is due to the irritation of acids flowing back as eructations from the stomach to the lower part of the oesophagus. The salivary glands become increasingly active in order that the acid may be diluted; the result is the bringing up of quantities of frothy fluid known as waterbrash. Food may relieve the burning pain temporarily; the pain may have become acute, but it returns again about an hour after eating and often the only relief is the taking of some suitable alkali.

2. *Flatulent Pain.*—This may occur when air has been swallowed or when hastily eaten or generally indigestible food is taken. The gas in the stomach collects in great volume, being expelled by travelling noisily up the gullet; often, however, it is difficult to expel and causes a severe oppressive pain, apparently in the region of the heart. Carminative drugs usually relieve it, but it may demand complete rest for an hour or two.

Both the above conditions are associated with a nervous irritability and are nearly always evidence of a mind working at high pressure. They are rarely found in organic disease but indicate extreme sensitivity of functional response to an active mentality.

3. *The Pain of Organic Gastric Disease.*—Many of the symptoms, including pain, of early organic disease of the stomach, such as gastritis, ulcer or cancer, were at one time thought to be due to " dyspepsia," the word covering a multitude of indeterminate conditions. More accurate knowledge shows that dyspepsia is *per se* associated with heartburn or flatulence and that the pain of early gastric or duodenal ulcer or cancer must be recognized as something apart. In early cancer pain may be constant but not severe; in the later stages the pain of cancer is boring and

distinctly upsetting to the patient's mind. Ulceration of the stomach is demonstrated by pain occurring immediately after meals; usually the pain radiates to the left side, but it is often referred to an area between the shoulders. The patient is afraid to eat because of the pain. This type of pain must be carefully distinguished from that of duodenal ulcer, which is worst from 2 to 4 hours after a meal and in the early hours of the morning (e.g. 2 a.m.) and which is relieved by eating (hunger pain).

4. *Pain of Colicky Type.*—This pain may occur after the eating of unsuitable food containing irritative materials or excess of roughage; it is essentially spasmodic in type and may cause the patient to draw up the knees on the abdomen, to roll about in agony and to resist examination owing to the tenderness of the abdominal muscles. Very often there is nausea during the intervals between the spasms. Colic may occur in ordinary indigestion or as the result of eating unripe fruit, poisonous berries or tainted meat. It may be associated with acute diarrhoea. In the region of the gallbladder, it is a sign of the passage, or attempted passage, of gallstones. It may be a sign of appendicitis. Occasionally it is due to a functional spasm of the colon.

5. *Abdominal Pain in General.*—Pain in the abdomen may vary from the mild irritation of an over stimulated colon to the acute stabbing pain of appendicitis, located on the right lower half of the abdomen. Varying degrees of pain may indicate constipation, flatulence, diarrhoea, dyspepsia, appendicitis, peritonitis, enteritis or obstruction of the bowel by twisting, strangulation or involution, in addition to the diseases mentioned above. There are also abdominal pains associated with other diseases apart from those of the digestive system. The diagnosis of a disease from the symptom of pain alone is therefore almost impossible and nurses should avoid giving a name to any abdominal ailment without taking into account all the other factors at work. The indiscriminate use of purgatives, especially the giving of a dose of castor oil, in all sudden attacks of abdominal pain, is to be deprecated; many cases of simple appendicitis have been transformed into peritonitis of dangerous degree owing to careless use of strong aperient drugs.

State of Bowels.—Constipation has already been dealt with at some length in Vol. II, pp. 96 and 97. It is a condition which may have serious constitutional symptoms of a debilitating type, but the local signs may be very insignificant. While the routine of nursing in all disease involves careful attention to the evacuation of the bowel at regular intervals, the condition of chronic constipation as a separate disease must be understood. Many people are very healthy although the evacuation occurs only once in 2 days, but the majority of the human race have a

daily motion. In all cases in which there are more than 48 hours between motions—many people confess to the existence of the state for many days—constipation is a dangerous condition. There are numerous causes, the first being ordinary laziness of mind and body and neglect of the primary natural laws. But the general state of the health often accounts for a sluggish condition of the bowel. Thus, apart from the sedentary life and from general neurasthenia, all infectious fevers, chronic nephritis, all forms of anaemia and extensive paralysis are characterized by the constipated condition. There may be local pain in the rectum or anus, which makes the individual repressed towards the act of defaecation. Adhesions which result in kinks of the bowel or the common condition of lack of tone of the supporting structures of the transverse colon are also instrumental in the formation of pockets and of areas in which the bowel peristalsis is sluggish or actually absent. This in turn leads to retention of the faeces, with consequent mild poisoning, commonly but erroneously referred to as "auto-intoxication." Finally the important matter of diet has a great influence on the movements of the bowel; this has already been discussed. The signs of bowel stasis are usually headache, loss of appetite, a disinclination to do much mental or physical work and general depression. Sometimes there is dull pain in the back or on the left side of the abdomen. If the faeces have a habit of pressing on the rectum, the condition of piles may also be present.

The treatment of constipation is first and foremost that of re-education and the reinstitution of regular habits. Many people cure themselves by making a point of drinking several pints of water per day and of taking a certain amount of exercise. Massage, Swedish gymnastics and "physical jerks" are most beneficial. Of the various laxatives in use, cascara, liquid paraffin, aloin and small amounts of saline (in the morning) are popular. A favourite mixture is emulsion of paraffin with agar-agar and phenolphthalein, twice daily. In many illnesses a purge is indicated at periods, and owing to the sedentary life in hospitals it is almost essential that some form of laxative should be given to the patients as they require it. The list available for this purpose is given on p. 112. In normal circumstances, however, there is no need to administer drugs for constipation and since the habit of taking laxatives is easily formed, it is wise to try the effect of diet and regular habits before resorting to medicines.

Diarrhoea.—Although diarrhoea is often a sign of intestinal disease it may occur as a result of disorganization of the function of the intestines. Thus the wrong type of food, over-ripe or unripe fruit, certain irritating drugs, excessive drinking of cold water or taking of too much ice cream, hot weather or sudden

cold weather, and excitement, fear or other emotions are all responsible for attacks of diarrhoea. The frank overeating of the healthy schoolboy on occasion may terminate in a spell of diarrhoea which may relieve the congestion and put the metabolism back to normal again. Constipation may alternate with diarrhoea. Very often diarrhoea is a terminal symptom of wasting disease and it may be very troublesome in chronic heart and lung disease, in portal congestion, in gallbladder disease, appendicitis and so on. If there is too much sugar, or fat or green vegetables and fruit in the diet, the bowels tend to become unduly loose. Sometimes very nervous persons are so stimulated by eating that they have a motion after every meal (lienteric diarrhoea); this also occurs in hyperthyroidism, owing to the increased rate of metabolism. The diarrhoea of colitis, food poisoning, enteric fever, dysentery and other conditions in which there is an erosion by ulceration of the mucous membrane lining the alimentary canal, is described under the heading of the appropriate disease. In many instances, there is irritation of the anus and a desire to pass faeces, but nothing happens except the occurrence of pain. This is known as tenesmus and is a very demoralizing condition for the patient.

The stools should always be examined if possible, even in functional diarrhoea (see Vol. II, Section IV). The treatment, apart from organic disease, is concerned first with the removal from the bowel of the irritating matter, and for this castor oil is the classical remedy, but care should be taken to ensure that the diarrhoea is not due to appendicitis or other severe surgical condition for disaster may result from careless giving of such drug. Sometimes a soothing opium powder is administered afterwards, and it may be necessary to combine opium in small doses with bismuth salicylate, or to give a lead and opium pill or an astringent for a day or two. The diet should be as light as possible, and in certain cases in which there is a degree of debility a day in bed may do much good, warm applications being put over the abdomen. Many people with sensitive intestines find that a day's starvation during which only distilled water is drunk, is very helpful. Very rarely in ordinary functional diarrhoea, a sedative colon douche or an enema of starch and opium may be prescribed (see Vol. II, Section VI). Sometimes so-called diarrhoea is actually the result of severe constipation. The retained hardened faeces, irritating the rectum, cause frequent passage of small quantities of blood-stained mucus. When the rectum is emptied by means of enemata, the diarrhoea disappears.

Character of Stools.—(See Vol. II, Section VI.)

Jaundice.—Jaundice is the result of the presence of bile pigment which, circulating in the blood stream, is deposited in the

skin or mucous membranes, giving a yellowish-green tinge of varying depth.

Obstructive Jaundice results from a general catarrh of the common bile duct and may occur in epidemics ; it may also be caused by obstruction of the common bile duct due to gallstones or external tumours. The urine is dark green and owing to the damming back of the bile within the liver none reaches the intestines, so that the stools are pale like clay. The patient in this case usually has irritability, general depression, flatulence, lack of appetite, nausea, bleeding of the nose, and great itch of the skin. The stools may be large but are usually of constipated type and very offensive; they are often greasy in appearance. These effects are due to the absence of bile which when present stimulates peristalsis, disinfects the faeces and helps to digest the fats.

Toxic Jaundice may be the result of certain poisons (including chloroform, mushroom poisoning, snake-bite poisoning), or of septicaemia, malaria, pneumonia, yellow fever, typhus fever and scarlet fever.

In both cases the bile is irritant to the tissues and causes many extreme nervous lesions, and its absence from the bowel is a disturbing factor to the whole process of digestion and absorption.

The treatment depends upon the cause; mild jaundice may be relieved after a few weeks of careful dieting, combined with rest, and the taking of small quantities of calomel at night and saline purges in the morning. Fats are not tolerated and should be omitted as far as possible from the diet. Carbohydrates, especially glucose, may be given in fairly large quantities. The itch is often soothed by bathing in warm water to which has been added a quantity of sodium bicarbonate or weak phenol lotion.

Diseases of Special Organs or Regions

In the following brief account of the chief diseases of the alimentary system, only those of purely medical interest are discussed. The remainder are dealt with in Vol. IV, in which, since they are more surgical than medical in nature, the majority of the diseases of the digestive tract are found.

Diseases of the Mouth

The mouth is the porch of the alimentary canal and like its prototype of the house is subject to the debris of all the ingoing traffic. Organisms of all types are deposited from the food and the air, fine particles are left to disintegrate after each meal and the very nature of the structure makes the mouth an ideal place

for cultivation of microbes. Chronic phthisis may also assist in the degenerative processes of the mouth; sputum constantly coughed up and perhaps held up in the mouth, is a powerful toxic agent. The chief diseases are as follows.

Stomatitis.—The causes of stomatitis are varied. Teething, fevers, anaemia, all play their part in setting up an inflammation of the mucous membrane, with or without permanent damage. Any form of persistent irritation, as by the thumb of a child who is addicted to thumb-sucking, or the stem of a clay pipe or the sharp edges of rotten teeth may set up stomatitis, and it may also be the evidence, in no uncertain fashion, of excessive dosage of mercury. The following types are recognized.

Simple Stomatitis.—This is a very mild type of stomatitis, which probably depends upon irregular dieting or sleeping with the mouth open and so allowing escape of saliva and dryness of the mouth. Red painful patches may be seen; they are very sensitive to hot food and drink; later there is a greyish covering of heaped-up epithelium. The best treatment is the application of glycerine of borax, after careful mouth washing.

Aphthous Stomatitis.—Although this is said to occur chiefly in children, it may also be found in certain districts among adults. It usually follows indigestion or infectious fevers and is very common in children under 3 years of age. Small vesicles or blisters form on the inner aspect of the lips, on the tongue and on the buccal mucous membrane; these break down and form ulcers like pin heads, greyish in colour. Chewing the food is an ordeal. The general health should be attended to. Locally the ulcers can be dealt with by applying, after every meal, first a simple mouth wash, then (by means of a pledget of cotton-wool) a little 50 per cent solution of hydrogen peroxide in warm water, after which the spots may be touched with glycerine of borax.

Ulcerative Stomatitis.—This is a more severe type indicative of great debility and often found in children after they get their first teeth. The margins of the gums are ulcerated and swollen. In certain types the ulcers burrow down to the alveolus bone and loosen the roots of the teeth; neighbouring glands swell. The treatment is application of potassium chlorate locally and internally.

Parasitic Stomatitis.—Commonly called thrush, this is often the result of dirty teats on feeding bottles or other unhygienic conditions of the child's home. The cause is a parasite, the *Saccharomyces albicans.* Irregular white patches on the throat and inside of the mouth occurring in groups give the appearance of a thrush's breast, hence the name. In addition to the usual difficulties of pain and difficulty of swallowing, there is foetor of the breath and associated indigestion. The patient is very debilitated, especially when the patches run together and form a

membranous cover of grey mucus. The treatment consists first of insisting on scrupulous cleanliness of the feeding bottle; secondly the mouth must be washed out frequently; thirdly the areas should be painted with weak glycerine and iodine, or honey and borax. Tonics such as cod-liver oil and malt are ndicated.

Gangrenous Stomatitis.—Gangrenous stomatitis is known also as *cancrum oris*, or *noma*—once seen, never forgotten. The child becomes rapidly in a state of semi-collapse and dies in a few days. Locally there is an angry spot on the inner aspect of the cheek. This grows rapidly and forms a perforating ulcer, and the cheek is literally eaten through. The condition is offensive and causes increased toxaemia in a young child recovering perhaps from measles and with little or no resistance to further disease. In the rare cases of recovery the area is widely excised and the edges touched with phenol. Repair of the hole bored in the cheek is undertaken when the child is stronger.

Pyorrhoea.—This disease, usually associated with a long history of dental caries, is the result of the harbouring of bacteria in the margins of the gums. A chronic state of sepsis is set up, and the constant discharge from the various foci, slow as it may be, is the cause of debility and chronic toxaemia, which has a far-reaching effect on the joints, the stomach and other organs.

The disease usually progresses until there is degeneration of the alveolar processes of the jaw bone, and when the radical method of treatment by complete extraction of all the teeth is done there is little hold for a false denture. It is with the prevention, and not with the cure of pyorrhoea, that we are concerned. Probably the source of pyorrhoea is weakened resistance of the whole dental area, and that which concerns carious teeth applies to pyorrhoea as well.

Dental Caries.—Much more is understood about dental caries now than formerly. This is undoubtedly due to the researches of prominent biochemists, who have made a life study of thousands of school-children and who have subjected many groups to prolonged tests and investigations. The diet is obviously the basis of health, and this applies especially to teeth. The natural life of the savage is free from all complex foods and therefore dental caries is a rarity among native tribes, gipsies and the tinker families who roam Scotland. As soon as the mother begins to load the child's stomach with fancy foods the process of tooth degeneration starts. It is by no means a local action. An ample supply of vitamin D is essential for sound development of bone and tooth; the necessary calcium and phosphorus may be present, but they are useless unless there is a good supply of ergosterol and plenty of sun to irradiate it and

thus to liberate vitamin D. It has been proved by experts that milk and fresh vegetables must be taken more and more and cereals less and less. Teeth developed in these circumstances have been proved to be strong and soundly laid down. Children who have been denied the above essential food elements are found to have teeth the structure of which is imperfect. Such teeth are easily overcome by the acids of carbohydrate fermentation, and, once established, the organisms of dental caries soon gain the mastery. It must be remembered that dental decay of the milk teeth is almost invariably followed by caries of the permanent teeth. Another important point is that the disease of the tooth may not be evident; a slight pain at the root of an apparently healthy tooth may be the indication of an abscess which is poisoning the blood and the whole system. It has been proved that the removal of teeth for rheumatism and similar complaints when done early has had considerable effect owing to the removal of the toxic elements from the circulation. There are thus two methods of dealing with dental caries. The first is the fundamental one of diet, planned according to the above rules. The second is the keeping of the teeth in a clean state from the very day the first milk teeth appear. Dental hygiene is fully discussed in Vol. II, pp. 95 and 96, and need not be enlarged upon. In the event of dental decay being discovered it can be rectified to a certain extent by correcting the diet and naturally the good offices of the dentist must be taken full advantage of, not only for the extraction of hopeless teeth but for the clearing and filling of cavities in a state of active disease. When pyorrhoea is found, local antisepsis by spraying or the use of a fine jet of carbonic acid gas have been tried with varying results. Inoculations have had little success.

Diseases of the Stomach

Dyspepsia.—As already mentioned, dyspepsia is more of a symptom than a disease. The term is still used to indicate functional as against organic, derangement of the stomach, but the old idea of the existence of acid dyspepsia, or atonic dyspepsia, has given place to the theory that the symptoms associated with these conditions may be those of early or temporary local gastric organic disease or of constitutional debility. Nervous dyspepsia is a true functional condition, characterized by the pain already referred to at the beginning of the chapter, and by flatulence and other discomforts. It must be regarded as a sign of an abnormally balanced nervous system, this comprising negative as well as positive states and accounting for many symptoms and signs forming an individual complex. Worry, overwork, wrong food, hasty meals, too many cigarettes or simple ennui may be at the

root of the trouble. The stomach is a sensitive barometer of the nervous activity. People with active neuroses show increased activity of the secretion (hyperchlorhydria), unusually active peristalsis (borborygmi), more embarrassing than uncomfortable, or spasm of the stomach, causing pain. Most of the distress is due to worry over the probables of cancer and other dangerous diseases. On the other hand the appetite may be deficient; there may be loss of tone of the stomach and intestines with marked prolapse or defective secretion of acid (hypochlorhydria) in those of phlegmatic disposition. The contrast between the two types is remarkable, and there is no mistaking the active for the passive dyspeptic. Treatment is as varied as are the causes but the fundamental cure must come from the mind. The taking of alkalis is a mere neutralization of a temporary nature. What is essential is to influence the control of the nerves to the stomach, stimulating them in one case and reducing their activity in another. The individual and not the disease must have attention. Adjustments may have to be made at various points. One patient may require daily massage, a second may have to go on holiday, a third may have to be carefully dieted. Drugs do not provide the key to the situation; in fact the less they are used the better. Nervous dyspepsia is one of the most difficult and most prevalent troubles in general practice and the nurse may meet with great obstacles, but she must realize to the full that great patience and perseverance are required of her, together with an understanding of the individual reactions to life in general of the patient in her charge.

Gastritis.—Inflammation of the stomach may be acute or chronic, the degree depending upon the amount of irritation. In the acute types, which are present in young and old at Christmas, frank overeating may be the cause, but excess of alcohol is also responsible, and bad food and drink, even in moderation, may set up acute inflammation of the gastric mucous membrane. The signs are nausea, sickness, lack of appetite, furred tongue and vomiting. Severe headache may occur and the temperature may rise slightly. The stomach is tender on pressure over the epigastrium. The acute gastritis of corrosive poisoning may end fatally in a few minutes, but recovery is usually speedy and complete in the dietetic cases when starvation, salines and solitude for one or two days is the advice given to the patient. Milk and soda water, equal parts, should be provided in gradually increasing quantities as the patient recovers. Chronic gastritis may supervene after several acute attacks or as the result of too many daily cups of tea, but it is nearly always typical of the rather thin red-eyed chronic topers, who are in the habit of taking an excessive amount of alcohol every day. Dyspeptic symptoms are common. All alcoholic cases are characterized by lack of

appetite for breakfast, by sickness first thing in the morning, with vomiting of thick offensive mucus; with the advance of the day and the consumption of alcohol, the appetite improves and food is taken, but it passes into a very inefficient container and apart from the defective digestion it receives it is hardened and becomes an irritant to the lower bowel. The breath is heavy and has an odour somewhat like that of sweet apples; this is a serious sign, indicating great metabolic derangement. Chronic gastritis may also be a sequel of persistent gluttony or of the constant swallowing of sputum by phthisical subjects. Treatment of these conditions must be prolonged, especially with alcoholic subjects, who provide hundreds of trained nurses with steady jobs all over the country. Many patients are improved rapidly by the simple process of being properly understood; sympathy and the removal of overpowering worries soon prove beneficial. The diet must be simple yet attractive, and in small portions. Milk and soda water may be required at the beginning, especially when the stomach is being washed out regularly with weak alkaline mixtures. The bowels should be kept free but not purged. Liquid paraffin is often successful when given in teaspoonful doses after each meal. Common drugs in use are pepsin, hydrocyanic acid and bismuth salts. Apart from the chronic gastritis which is a sign of cancer, cirrhosis of the liver or advanced heart disease, there is a clear road to convalescence, if the bowels be free, the appetite stimulated and the cause of the trouble completely removed.

Peptic Ulcer

The present day conception of the ulcer which may occur at some point in the lining of the stomach or duodenum is that there is little or no general difference between the gastric ulcer and the duodenal ulcer Peptic ulcer is discussed later on in Vol. IV, Section X, but these ulcers are not always treated surgically and often respond well to medical treatment, which may have to be continued in a modified form indefinitely The treatment of gastric and duodenal ulcer is similar. The following are the main points.

Diagnosis.—The diagnosis is established in 3 ways.

1. By taking a series of x-ray photographs; these are not by any means infallible, the clinical condition of the patient being of greater importance.

2. If the x-ray pictures are inconclusive, gastroscopy may be performed; the inside of the stomach is actually viewed by means of a flexible gastroscope.

3. A fractional gastric test meal is examined to ascertain the degree of acidity of the gastric contents. In gastric ulcer there is

hyperacidity (hyperchlorhydria); in carcinoma of the stomach and pernicious anaemia there is no acid (achlorhydria); in some cases of gastritis there is diminished activity (hypochlorhydria).

Blood grouping should be done and a blood count should be made. The former is necessary in case blood transfusion becomes urgent. If the patient is found to be anaemic some form of iron must be administered.

The stools should be examined in the laboratory for occult blood.

Treatment.—Rest in bed for some weeks is usually necessary and this measure alone goes a long way towards recovery as the "gastric" patient is often of the worrying, anxious type, who is constantly at war with himself. Mental as well as physical rest should be obtained if possible.

The diet prescribed depends upon the ideas of the physician. (See pp 182 and 183.) It cannot be too strongly emphasized, however, that peptic patients must not be starved. In many cases of gastric and duodenal ulcer the patients do not get sufficient nourishment and their vitamin requirements are forgotten so that instead of improving, their condition is rather made worse. A weekly weight chart should show a steady increase when the diet is sufficient.

Gastric acidity is counteracted by dosage with alkalis, but alkalosis is not uncommon and symptoms of headache and nausea should be regarded with suspicion. Belladonna is also prescribed to inhibit gastric activity. Symptoms of overdose are evidenced by excessive thirst, dilated pupils and dimness of vision. Often there is pylorospasm, for which a sedative like phenobarbitone is excellent.

Intragastric drip feeding is sometimes successful when ordinary methods of dieting fail. A Ryle's tube is introduced into the stomach via the nose, and 6 pints of citrated milk are allowed to drip during 24 hours, day and night, at a rate of about 40 drops per minute. There are variations of this method. The milk may have aluminium hydroxide added to it.

The tube should be taken out, washed and boiled together with the other apparatus on alternate days. Healing of the ulcer usually takes place in 2 to 3 weeks. X-ray pictures sometimes show stages in the process of healing.

The mouth hygiene is important. The teeth should be examined for caries and septic foci in tooth roots and tonsil beds carefully sought for and dealt with. Daily toilet of the mouth must never be neglected.

The use of liquid paraffin is often sufficient to prevent constipation. Strong purgatives should never be used.

Smoking and alcohol should be discouraged for some months. When the patient returns home from hospital he should be

thoroughly conversant with the regime required of him and should report from time to time until cure is complete. Sometimes it may be advisable for him to change his occupation if that be possible, for gastric and duodenal ulcers frequently occur in persons who are proverbially " square pegs in round holes."

Complications.—Complications of gastric ulcer include pyloric stenosis and hourglass stomach from scarring; and perforation; malignancy occasionally develops on the site of an old ulcer. These, however, are surgical complications. Melaena often occurs in duodenal ulcer, haematemesis which may be slight or very severe, in gastric ulcer. These sometimes constitute acute medical emergencies

Haematemesis.—The treatment of haematemesis depends upon the degree of bleeding and the condition of the patient. Morphine is usually ordered to allay distress and ensure rest. The patient is nursed lying flat with one small pillow for the first week. The mouth hygiene is important. In severe haematemesis, it is sometimes wise to withhold anything by mouth for the first 48 hours. Barley sugar to suck is usually allowed, but ice is not a good thing as it tends to make the patient more thirsty. After two days Sippy's or Lenhartz's diet can be commenced. When bleeding is severe intravenous glucose salines or blood transfusions are given. The bowels should be confined for 3 or 4 days, after which glycerine enemata can be given every other day and liquid paraffin by mouth.

In less severe cases a more liberal diet may be allowed if it can be tolerated. The diet devised by Meulengracht and modified by Witts gives a much greater variety and a higher caloric intake. The patients concerned are often poorly nourished and usually do much better on a fuller diet. If further bleeding should occur they are in a better condition to bear it. There is no justification for starvation longer than is absolutely necessary.

Diseases of the Intestines

Many of the diseases of the intestines are of a surgical nature, and as such are described in Vol. IV, Section X. The principal intestinal parasites have been dealt with in Vol. II, Section III. There remain the various forms of enteritis and colitis.

Enteritis.—Inflammation of the small intestine of acute character occurs in many diseases of an infectious type (e.g. dysentery, typhoid fever), but putting these aside for discussion later on, we may confine our present studies to the inflammation that causes a catarrh of varying degree and which results from bacterial activity. The intestines are full of organisms, and it can be imagined that the latter are ready to seize every opportunity

of becoming active when the local resistance is lowered by the effects of irritating food or of ordinary cold. The mucous membrane may show all degrees of involvement, ranging from the slight catarrh of the cells to ulceration and perforation of the bowel wall. No matter how mild the condition may be, however, the reaction of pain, colic and diarrhoea is usually very brisk for a period and may result in great debility. The following forms must be distinguished.

1. *Catarrhal Enteritis.*—This is the common type of intestinal irritation which follows excessive purging or a long period of administration of drugs such as mercury or arsenic, or over-indulgence in alcohol for a long time. A sudden change of weather or alteration in the drinking water may cause it. But perhaps the best known and most frequent source of enteritis is the house-fly, which is responsible for a great deal of bacterial dissemination in hot weather. Milk, vegetables, meat, fruit and other provisions quickly decompose when the temperature is high, and if such food be eaten the swallowed germs become active and collaborate with the numerous bacteria of the intestinal tract to cause severe enteritis. The condition may pass from the acute to the chronic state in which the large intestine shows extensive damage to the mucous membrane. The symptoms of the acute condition are pain occurring in spasms in the umbilical region, profuse watery diarrhoea, with offensive stools, loss of appetite, dry mouth, nausea, occasional vomiting and sometimes low fever. If the irritation should be high up in the canal (small intestine) the stool will show, in addition to the shreds of membrane, particles of undigested food; when the colon is the site of the inflammation the stool is characterized by great quantities of mucus—a very important point. Microscopically the stools show numerous bacteria. If the infection be severe the disease may rapidly progress to collapse with rapid pulse, and even to death. Recovery is usually quickly brought about, however, by appropriate treatment; rarely does the condition become chronic. If the latter type of enteritis should supervene, the symptoms are chronic diarrhoea following a sharp attack of colic, with small stools, containing much mucus. There may be periods of constipation, then a spate of diarrhoea The constitutional signs are those of chronic toxaemia—pale dusky complexion and loss of weight. In order to avoid complications it is best to put the patient to bed at once. A day's starvation does no harm, sips of boiled and cooled water being given, or milk and brandy. Sometimes castor oil or a Seidlitz powder may be given as a preliminary to clear out the intestinal debris. Fomentations or turpentine stupes may be indicated. The patient should be kept as quiet as possible, and very often the doctor gives one-sixth of a grain of morphine. In severe cases rectal feeding and

astringent enemata may be necessary. Great success usually follows the giving of a mixture of bismuth salicylate and chlorodyne. The greatest care should be taken in the building up of the diet afterwards.

2. *Gastro-enteritis of Children.*—This type of enteritis is commonly encountered as "summer diarrhoea," and affects children mostly between the ages of 2 months and 2 years. It is often due to improper feeding and coincides with a hot spell of weather. There is a type of gastro-enteritis in children which may occur at any time of the year and which is often due to faulty dieting and nothing else. It is characterized by green stools of strong odour, containing undigested milk protein and usually frequent and scanty. A grey powder with sugar of milk, and the rectification of the diet, may put matters right very quickly. When the more severe type of summer diarrhoea is active, flies may be blamed for the epidemic form taken by the disease, which is disseminated by milk. The child looks wasted and ill. In a few hours he may become weak and pale, with a temperature of 103° to 105° F., lustreless eyes, dry tongue and even collapse. Vomiting and watery diarrhoea of a most offensive type occur as often as four times an hour. There is tenderness of the abdomen, tenesmus and sometimes prolapse of the rectum. The cure is as dramatic as the onset. Bismuth salicylate and chlorodyne as above, given every hour in small doses, together with sips of brandy and water, and abundance of sterile water bring relief in nearly all cases, and in 2 days the child is almost normal. All milk and artificial foods should be boiled when these conditions are present, despite the alteration in the constituents. Sometimes, in very acute conditions, the giving of a mercury powder or castor oil may be necessary, and feeding by albumen water and barley water may have to be instituted until the worst is past. The collapse may demand rectal or subcutaneous salines, and rapid improvement follows the washing out of the stomach, as already described in a previous chapter. The cases which are chronic from the start generally indicate a poor state of general health and the child lingers on, with symptoms of distended abdomen, pale, sticky stools and final collapse. Death results from the general toxaemia.

Ulcerative Enteritis.—Ulcers in various parts of the intestine may be found in the following diseases, which are dealt with separately elsewhere in this work: tuberculosis, syphilis, dysentery, typhoid fever, peptic (gastric and duodenal) ulceration, chronic constipation, obstruction and strangulation of the bowel.

Ulcerative Colitis.—This disease occurs mainly in young adults or middle-aged persons. It is due to a bacterial infection but the actual causative organism is not known. When the

colon is examined by means of the sigmoidoscope the presence of large ulcers is demonstrated.

The onset of the disease is often sudden, the first attack of diarrhoea occurring without warning. In a mild case there may be only 3 or 4 evacuations daily, but when the disease is severe the diarrhoea may be almost continuous. The stools are green, copious and very offensive, with masses of pus and often a considerable amount of blood. The patient loses weight rapidly. There is fever and the pulse is rapid and weak. The attack may subside with rest and treatment, but relapse is common. Death may occur from toxaemia, dehydration, or haemorrhage, or from perforation of the bowel wall with consequent peritonitis.

Treatment.—Complete rest in bed is essential even in mild cases. The diet is of importance. The debilitating nature of the disease demands as much nourishment as possible, with the minimum irritation of the bowel wall. A high-calorie non-residual diet, including lightly cooked fresh minced meat, eggs, citrated milk, vegetables made in a *purée* and strained fruit juice is essential. The vitamin content should be high. Any foods known to be irritative must be carefully avoided.

For local treatment high colonic lavage with saline or warm water is sometimes ordered, but is not very effective. Starch and opium enemata may have a local sedative action. Sulphonamides by mouth and as retention enemata have recently been tried but results so far are inconclusive.

Mucous Colitis.—This disease must not be confused with ulcerative colitis. Mucous colitis usually affects middle-aged or elderly women of a neurotic disposition. It is often associated with chronic constipation, although several stools may be passed in the 24 hours. These may consist merely of a little mucus and blood, but sometimes a mucoid cast of the bowel is passed. The disease runs a chronic course and is not very amenable to treatment.

Treatment.—Psychotherapy is often of value. If the people concerned can develop an interest beyond their own physiology, the condition often improves. The diet should be of a high residual type (e.g. containing a fair amount of roughage). Fluids may be taken in abundance. Strong purgatives are to be avoided but in view of persistent constipation, lubricants and mild aperients (liquid paraffin, agar or senna) are necessary. Sometimes enemata are ordered but these serve to focus attention on the bowel and are best avoided.

Diseases of the Liver and Gallbladder

Cirrhosis.—In this disease there is an overgrowth of the supporting structure of the liver, owing to chronic and long-

standing inflammation, the result of alcoholism. The liver becomes contracted and its surface has the typical "hobnail" appearance, which is characteristic. It is common in males of middle age with a long history of steady drinking of spirits, indeed the liver is known as "gin drinker's liver." It is thought that the effect of alcohol is to induce fatty degeneration of the liver cells, with a free field for microbes, which gradually increase the fibrous tissue at the expense of the hepatic cells and so reduce the work of the liver by degrees until serious constitutional effects are produced. The early signs are those associated with alcoholic gastritis, but as the disease progresses bleeding from the nose and from the stomach may be warning signals. The face is rather pale, but the nose is red with blue dilated veins and the veins on the abdomen are so prominent that they form a pattern known as the "Caput Medusae." Ultimately, the general degeneration is shown by jaundice, ascites, nephritis, mental derangement and heart failure. The patients in such cases are usually their worst enemies, as it is very difficult to break them of their alcoholic habits. The prognosis is therefore very bad. The bowels should be kept loose by calomel and salines; plenty of fluids should be taken, but no alcohol. Milk and soda water, barley water, junket, custard and all the more easily digested foods are indicated. Sometimes it is necessary to tap the fluid from the ascites. Drugs are notoriously non-efficacious.

Hepatic Abscess.—Abscess of the liver may result from suppuration elsewhere—appendix, large intestine, gallbladder, piles, intestinal glands and so on. Secondly there may be scattered and minute pyaemic abscesses of the liver, the germs reaching the liver substance by the vessels. Thirdly tropical diseases such as dysentery may cause large single abscesses, which often rupture. In all 3 types the symptoms are those of septicaemia, with rigors, high temperature and rapid death, except when the condition is recognized early and vigorously dealt with. In the tropical abscess the contents of the abscess are like anchovy sauce and very offensive. If a patient with suspected liver abscess begins to cough up sputum of this type it may be concluded that the abscess has ruptured into the right lung.

Other Conditions.—Passive congestion may be part of chronic cardiac or pulmonary disease, resulting in increase of the venous field. It is usually a distinct phase of heart failure and should never be treated as a separate disease, although locally the congestion may be reduced by leeching and the strain on the liver can be relieved by calomel and salines.

Fatty Liver.—The liver may be found to be fatty in general obesity, but it is more frequently a degenerative process associated with systemic poisoning by alcohol, anaemia, phosphorus,

tuberculosis, or with cirrhosis of the liver itself. The treatmen depends upon the cause.

Waxy Liver.—This is also known as lardaceous or amyloid disease, and results from long continued suppuration of bones, glands or other parts. There is no pain, but the liver is enlarged and heavy. The spleen is also enlarged. The cause of the condition requires vigorous treatment.

Acute Cholangitis.—This is also known as catarrhal jaundice and gives rise to the signs of icterus, or jaundice, described at the beginning of the chapter. The end of the common bile duct becomes occluded by congestion, probably due to a microbic invasion, and bile is held up in the liver, ultimately flowing back into the blood stream and causing the characteristic yellow tinge. The symptoms and treatment are as already described. The symptoms usually clear up in 3 to 5 weeks.

Diseases of the Pancreas

Acute or chronic pancreatitis may be found, but like all pancreatic disease it is rare. The signs of the acute condition are very like those of appendicitis. The treatment is usually surgical. Cancer is rare also. A slow degeneration of the cells of the organ may result in the formation of great cysts filled with fluid.

CHAPTER 5

DISEASES OF URINARY ORGANS

GENERAL SYMPTOMS. PAIN. FREQUENCY OF MICTURITION. HAEMATURIA. DIAGNOSIS IN URINARY DISEASE. ESTIMATION OF UREA. THE UREA CONCENTRATION TEST. BLOOD UREA. OTHER ABNORMAL CONSTITUENTS. RADIOGRAPHY. CYSTOSCOPY. ACUTE NEPHRITIS. CHRONIC NEPHRITIS. PYELITIS. CYSTITIS. URAEMIA. OTHER MEDICAL DISEASES OF THE URINARY SYSTEM. HYDRONEPHROSIS. FLOATING KIDNEY.

PREVIOUSLY in this work reference has been made to the importance of the urine in all diseases and to the necessity for very careful testing in every case. The fact that so much attention is paid to the urine indicates that the urinary system is closely connected with all the other systems and it is very rarely that an uncomplicated disease of the kidneys or bladder is found. Nevertheless certain clearly defined conditions are recognized.

General Symptoms

It is sometimes very difficult to decide whether a urinary disease belongs to the medical or to the surgical category; many medical diseases show symptoms and signs which are very like those of the surgical conditions. In all urinary disease, pain, increased frequency of micturition and haematuria, each of variable degree, are the commonest symptoms but we have already noted also that we may find polyuria, incontinence, enuresis, suppression of urine, retention and the general constitutional signs associated with them, and a full investigation must be made by modern methods before a final decision can be arrived at regarding the policy of medical or surgical treatment.

Pain.—Nurses must carefully consider the 3 cardinal signs of urinary disease. Pain may occur in the small of the back, on one side or on both sides; when this is so it is likely that the trouble is located in the kidneys; absence of pain does not mean that the kidneys are unaffected. If the pain shoots down from the lumbar region to the groin and is of an acute stabbing character, causing the patient great distress and even making

him roll about on the floor in agony, it is almost certain that renal colic is active i e. the passage of a small stone down the ureter. Bladder ailments result in chronic irritability of the urethra, generally of a hot, burning character, but sometimes in males the pain at the tip of the penis is almost as severe as the pain of renal colic.

Frequency of Micturition.—A most careful watch must be kept for the occurrence of frequency, the causes of which are given in detail in Vol. II, pp. 367 and 368. It must be remembered that the drinking of excessive quantities of water, the presence of exciting factors such as fear or apprehension or the influences of a very cold day may result in increased frequency, but this is not necessarily a sign of urinary disease. In many cases of inflammation of the kidney the frequency is serious enough to transcend all the other factors, but the complete proof is invariably found when observation is made during the night. A patient who is roused from his sleep on account of a desire to pass urine more than twice a night is undoubtedly suffering from frequency. It will be observed that those who become chronic sufferers from this upsetting complaint develop a redness and a tiredness of the eyes which is unmistakable.

Haematuria.—When there is blood in the urine, no matter how small the quantity may be, we say that the condition of haematuria exists. The blood may cause merely a smokiness of the urine or it may turn the urine almost black. Sometimes the most careful tests have to be made. The common causes of smoky urine are acute nephritis or early stone or disease. Copious blood is found (in amounts depending upon the extent of the bleeding) in tuberculosis of the kidney or bladder, in cancer of the kidney, ureter, bladder, prostate gland (in the male) or urethra, in injury or obstruction of the vessels of the kidney, bladder or urethra. Inflammation of the bladder (cystitis) may also be characterized by a period of haematuria. In some cases scurvy, malaria, parasites, drugs, blood diseases such as purpura may cause a similar condition. There is another urinary disorder known as haemoglobinuria, which is clearly distinguished from haematuria. In the latter the blood corpuscles can be recognized undamaged in the urine by microscopical examination; in the former the chief element is the blood pigment (usually methhaemoglobin, a dark brown element) and very few corpuscles are found.

Diagnosis in Urinary Diseases

In addition to all the urinary tests mentioned in previous chapters, there are others of a much more advanced nature

which are made when necessary by experts in the laboratory. These tests are described briefly below so that the nurse may have an understanding of their principles, but it should be understood that she will never be expected to carry them out in the same way as she is supposed to make the routine tests for albumin, blood, bile and sugar. They are mostly of great biochemical importance, and have a far-reaching effect on the course and treatment of the disease. In recent years they have become indispensable in the complete diagnosis of intricate conditions and physicians and surgeons place great stress on their significance.

First of all, however, the nurse must ask herself how she can help in the diagnosis. She is with the patient for hours at a time, and her observations may carry great weight. She can keep an accurate note of the type of pain, how often it occurs and its relation to the passage of urine; she can observe the character of the frequency; she can do her part in the investigation of the urine after it is passed. But one of her most important duties is the observation of the passage of blood. When the kidneys are affected the blood when passed with the urine is evenly diffused in a smoky cloud; small clotted threads or larger shreds indicate that there is bleeding in the ureter. Again it may be important to watch the act of micturition. When blood is passed before the urine appears (i.e. is pushed out by the force of the urine behind it) it may be taken for granted that the bleeding is at some point in front of the bladder—the urethra. Blood which oozes out or which drops as a fair-sized clot from the urethra after micturition is over is probably from the bladder. A report on any of these factors will help the doctor considerably.

Estimation of Urea.—Normally about 2 per cent of urea is passed in the urine, this indicating that the kidneys are doing efficiently the work of removal of the end products of protein metabolism. There are various ways of measuring the urea. The quantitative test is made by estimating the amount of albuminous material taken by the patient, then finding out the total amount of urea passed in the urine. If there is a rise of temperature it is usually accompanied by great metabolic activity of the body, and as a result urea is increased in the urine. The same phenomenon is found in diabetes and in gout. On the contrary, when there is starvation or general debility, or lowering of the state of metabolism (e.g. in chronic nephritis) or loss of vital food factors by excessive vomiting or diarrhoea, the urea percentage drops considerably. This state of affairs may also result from inability of the kidney to extract excess of urea in the blood, which can be determined by the method described below. The two conditions must not be confused, however.

The method of calculating the amount of urea in a sample of urine is that of measuring the amount of nitrogen given off and

collected by special apparatus. Every volume of 371 c.cm. of nitrogen is equal to one gramme of urea. By using a specially graduated tube (see Fig. 63) the number of grains of urea in each ounce of urine may be ascertained and compared with the normal, which, in an active, healthy man passing about 50 ozs. of urine per day represents roughly a total of 500 grains, or 10 grains of urea in every ounce of urine—approximately 2 per cent. If therefore an adult workman is taking 120 grammes of protein a day, we should expect him to pass 500 grains of urea in 24 hours. If there is considerably more or considerably less, something is wrong with the metabolism.

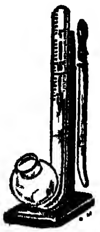


FIG. 63.—UREAMETER.
(By courtesy of the Surgical Manufacturing Co., Ltd., London)

The Urea Concentration Test.—This test is very important. It allows us to gain some knowledge of the activity of the kidney apart from organic disease; figuratively speaking it tells us whether the kidney is pulling its weight in the boat.

Overnight no fluid is given, generally for 8 hours, beginning at 10 p.m. At 6 a.m., after the patient has emptied his bladder, he is given a solution of urea made by adding 15 grains of urea to 100 c.cm. of water. After an hour the patient is told to pass urine. The urea is estimated. It should be above 2 per cent. There may be a delay, however, so tests are made every hour; the critical period is from the first to the third hour. During that time, the specimens should be well above 2 per cent in urea concentration if the function of the kidneys is good. Less than 2 per cent is an indication of poor function of the cells of the kidneys. This test is also known as the Renal Efficiency Test. Other tests may be done but they have not yet been proved to be infallible.

Blood Urea.—Urea which is not passed by the kidney is presumably held up in the blood. The blood may therefore be tested for urea at the same time as the urine is tested. There should never be more than 30 milligrammes of urea in every 100 c.cm. of blood; a fairly wide margin is allowed, however, and results up to 40 milligrammes need not necessarily indicate serious trouble. Above 45 milligrammes per cent is always a sign of lack of efficiency of the renal cells.

Other Abnormal Constituents

Uric Acid.—Half a gramme of uric acid is normally passed in the urine every day. It usually appears in the form of pink urates, but when an excess of meat is being taken or when there

is fever, bad circulation or gout or liver trouble, the small reddish-brown crystals of uric acid may be found lying like fine cayenne pepper grains at the bottom of the specimen glass.

Phosphates.—A somewhat milky-white deposit of "earthy" phosphates may occur at the end of micturition and this settles down at the bottom of the test glass after half an hour. In excess, these phosphates may cloud the urine and they cause much worry, especially as they are associated with a nervous temperament. They rarely indicate anything of a serious nature, however, frequently being the result of a bulky meal consisting mainly of vegetables.

Chlorides.—Sodium chloride is excreted to a certain degree every day. In acute pneumonia one of the main features is diminution of the chlorides in the urine. Casts of the tubules of the kidneys found in inflammatory disease of the kidney, various crystals of the deposited matter including oxalates and other abnormal constituents may be fully investigated by the microscope.

Radiography.—The urine may be examined by the above methods and by the tests studied in previous chapters, but in order to make further investigation of the urinary system, we may make use of other examinations, directly concerning the organs themselves. The most important method is that of x-ray. It is advisable to have the bowel clear, not only of solids but also of gas. On account of this the diet should be very light for 48 hours and on the night before the examination is to be made a laxative should be given, such as colocynth and hyoscyamus pill. Shadows cast on the screen indicate stone or calculus. These calculi vary in size from that of a millet seed to that of a mass weighing a few ounces. The small ones are the most difficult to determine and the fixation of their actual site may involve much skilled radiology.

A development of the x-ray investigation of the kidney is provided in the operation of pyelography, which may consist of two distinct procedures: 1. pyelography by instrumental methods, and 2. pyelography by excretory methods. In both these cases the pelvis of the kidney and its ureter are filled with a substance which casts a strong shadow on the x-ray screen. In 1, about 8 c.cm. of a 20 per cent solution of sodium iodide is injected up each ureter by fine catheter passed through the urethra. The patient generally feels some tension in the kidneys, and this is the sign that the amount of solution is ample. In 2, a substance known as Abrodil, or a similar substance, Uroselectan B, is given by the vein. These agents are quickly extracted fróm the blood by the kidneys, so that within 15 minutes the whole interior of the pelvis of the kidney and ureter is defined by a black shadow.

Further photographs are usually recorded half an hour and one hour after the injection is made.

Cystoscopy.—Primarily the cystoscope was intended for the examination of the lining of the bladder, a catheter with an electric bulb on the tip and a system of reflecting mirrors with great magnifying power being passed by the urethra and carefully swept round the bladder. Many types are now in use, and it is possible to pass catheters into each ureter as described later in Vol. IV, Section X, so that the urine can be collected separately from each kidney and examined. It is now also a common practice to inject intravenously indigo-carmine dye and similar substances and by observation of the coloured urine issuing from each ureter, the work being done by each kidney can be assessed.

Acute Nephritis

This is one of the commonest diseases known, frequently supervening on other ailments and causing grave complications. It is a non-septic inflammation of the whole fabric of the kidney, affecting chiefly the tubules, interstitial tissue and blood vessels, with the associated glomeruli. It is frequently referred to as Bright's disease owing to the fact that Dr. Bright first described it fully.

Causes.—1. A spell of cold weather, especially when there is much damp about, as during the English winter; 2. scarlet fever, and to a less extent other infectious diseases; 3. abnormal pregnancy; 4. severe burning accidents; 5. certain irritating drugs e.g turpentine and cantharides; 6. spread of infection from the bladder upwards. Acute nephritis may occur in epidemic form especially among soldiers on active service, hence the term peculiar to warfare, trench nephritis. It is found more in the male than in the female and it is not common after middle age.

Symptoms.—The symptoms are variable and depend upon the damage done to the various minute structures of the kidney. Both kidneys are usually equally affected. If the disease begins unostentatiously there may be passage by the bladder of urine containing albumin, and the patient may be quite unaware of it. Generally, however, there is a more or less acute onset, following depressive preliminary symptoms. The temperature rises, there is intense headache and there may be vomiting. It should be noted that pain in the back, which is advertised so much as a cardinal sign, may be absent at first; this usually comes on when the disease is well established. Ninety-nine per cent of those who suffer from severe pain in the back are victims of nothing more serious than lumbago.

The attention of the doctor having been fixed on the urinary

system, he usually finds that the eyes are puffy and there may be swelling or oedema of the ankles. The urine is smoky owing to the presence of small quantities of blood. The higher the temperature and the more scanty the urine the more evident are these signs of retention of poisons in the blood which should have been excreted by the inefficient kidneys; the real estimation of the case may be made by a close study of the total amount of urine passed in 24 hours. If the urine ceases altogether (anuria) it is a very dangerous sign.

A well established case of acute nephritis may show the following features: frequent passage of scanty blood-stained urine; oedema of all dependent parts and lax spaces, especially the eyelids, the back and the ankles and legs; pulse above 100, and obvious rise of tension in the vessel; examination of the urine; shows the presence not only of blood, but also large quantities of albumin, and under the microscope, casts of the tubules in all stages of degeneration; in time the patient suffers very much from thirst and is constipated.

Course of the Disease.—Several possibilities must be considered

1. The patient may gradually recover, the albumin becoming less and less and ultimately being reduced to a mere trace.
2. Heart and lung complications—pneumonia, pericarditis, cardiac dilatation.
3. General oedema, causing obstruction to swallowing, breathing and other functions.
4. A subacute state may develop, with a moderate amount of albumin in the urine.
5. Uraemia: the most dangerous complication of all. Severe headache leads to convulsions, coma and often death.

Treatment.—The first essential is, if possible, to relieve the kidney of strain. There must be complete rest in bed. Sweating is induced by clothing the patient in a warm gown and nursing him between blankets. In severe cases, when the urine is very scanty, hot wet packs are applied to the loins or a radiant heat cradle used to promote skin action. Dry cupping or leeching is sometimes ordered as a counter-irritant to relieve kidney congestion. During any of these rather drastic treatments careful watch must be kept for signs of collapse. The bowels are made to act freely, and for this purpose jalap or calomel followed a few hours later by a saline draught, are probably the most suitable purgatives since they produce watery evacuation, thus enabling the body to get rid of surplus fluid. Diuretics are of no use until the kidneys are able to do some normal work, but may be ordered later when kidney secretion is re-established.

The diet is important. For the first week fluids only are given and these should be limited to 2 pints daily for an adult and 1 pint for a child. Pure orange juice is excellent and this may be sweetened with glucose, but if this is not obtainable other fruit juices or barley water can be given. Toffees or glucose sweets are sometimes allowed. When the disease is abating the blood and albumin in the urine diminish, and oedema is lessened. At this stage copious fluids can be given to help to flush the kidneys of debris. The salt-free nature of the diet has already been stressed. As a result of the reduced activity of the renal tissue, the salts are retained in the blood; by giving a diet free of chlorides, the surplus in the blood is gradually used up by the tissues. At the same time, the fluids which have accumulated in the various oedematous areas as a result of their extraction from the blood (in order to make the salty solution less concentrated) are enabled to return to the blood stream. Proteins should be limited throughout convalescence. All the urine passed is saved and measured, albumin being tested for daily.

Finally it should be remembered that there is often an important subacute stage following the acute condition. During this period the patient may be able to hold his own, but the daily examination of the urine may show variable quantities of albumin, and until this is reduced to a mere trace or none at all, it cannot be said that the patient is clear. The dieting and nursing are very important during this period, which should be regarded as a prolonged convalescence. While proteins must be restricted, there is no reason why an abundant farinaceous diet should not be given, with plenty of fruit and vegetables; a preparation such as malt combined with a tonic is very suitable. The danger of relapses of a temporary nature must always be stressed. Bacterial invasion is sometimes responsible for this type of nephritis.

Chronic Nephritis

When we come to consider chronic nephritis we find that there are many aspects of this form of Bright's disease. The complexity of the situation is further increased by the participation of associated organs such as the heart and blood vessels. Many authorities have tried to make a comprehensive classification. It is very difficult to lay down hard and fast rules about the cause or the condition of the kidneys, but undoubtedly the way to a clearer understanding is found by making a study of the affected organs in the first place.

Morbid Anatomy.—Statistics from the post-mortem room and from the pathological laboratory show that it is possible to make two great general groups into which we can place the

kidneys examined in fully established chronic nephritis. With the two pictures clearly in her mind, the nurse may find that the understanding of chronic nephritis will come much more easily to her and for simplicity's sake it is best to limit the investigation to the conditions described below.

Group 1. *The Large White Kidney.*—This is found in the type of nephritis known as parenchymatous nephritis, and may be the result of an acute attack or of long continued constitutional strain. On close examination the kidney, which is much enlarged and pale, shows gross changes in all its structures—cells, tubules, vessels and supporting framework but the damage to the secreting machinery is outstanding, therefore the name, parenchymatous, is used.

Group 2. *The Small Red Kidney.*—In contradistinction to the above, it is the interstitial tissue that is chiefly affected. The kidney is red, granular and shrunken, a true condition of cirrhosis. If the nurse remembers these facts she will be able to appreciate more than half the troubles that afflict old people, especially those who suffer from that degenerative process, arteriosclerosis.

Causes.—If anything happens to be retained in the blood when it should be got rid of by the various channels of excretion it acts as a poison to the tissues. The blood vessels suffer, the cells suffer, the fibrous tissue suffers. The whole physiological machine is put out of gear. All these factors acting together produce debility, which may be demonstrated by anaemia, general weakness and difficulty in keeping the body from going to waste. As a result of these processes the various elements of the kidney, as mentioned above, become affected; the heart enlarges because it has too much to do against odds; the blood pressure is increased; in 1 out of every 7 cases a serious condition of the eye (inflammation of the retina) is found; dropsy of very advanced type may gradually supervene on oedematous conditions of the ankle and eyelids; the urine has abnormal constituents.

Types.—1. In the chronic parenchymatous type of chronic nephritis the immediate cause may be an acute attack, followed by an abnormal subacute stage (this is the reason why the nurse has to be so careful of the convalescence of acute nephritis patients). Sometimes, however, this type develops during infectious diseases, or as a manifestation of syphilis or as a result of long processes of septic poisoning. The urine is the guide to the state of the kidney; the microscopical examination of the casts shows clearly what stage the disease has reached. There is still doubt in the minds of the experts as to the development of this disease. Nurses must be content with the knowledge that chronic parenchymatous nephritis may begin with signs and symptoms,

including urinary reactions, very like those of acute nephritis, but as time goes on the case may develop into a less positive type and may show more urine with less albumin. The microscope however, shows that there is greater degeneration of the tube casts, and this is the deciding factor. 2. The chronic interstitial type is one of the most outstanding diseases in medicine. It is associated with the small red kidney and may be the result of long established constitutional disease such as gout, syphilis, lead poisoning and excessive consumption of alcohol or of strong nitrogenous food. It is one of the most discussed diseases of the world and is not yet fully understood, but it is probably an essential change forming a signal part in a slowly acting and very deliberate alteration of the whole fabric of the body. This is proved by the fact that chronic interstitial nephritis rarely begins until after the age of 40 and then often in those who have hereditary influences towards nephritis; that it occurs in those who have led a very hard and active life whether that life may be one of work or play; and that it is associated with coordinated symptoms in other parts of the body.

The urine is quite different from that of the parenchymatous type. It is clear, pale, copious and watery and often completely free of blood and albumin; although there may be one or two degenerated casts the characteristic of the average specimen is that there is little or nothing to see. The urea, however, is very much diminished and the blood urea very much increased, and this is the clue to the situation, which is very serious. The other symptoms are well marked. The heart is enlarged, but dropsy is not a feature until the heart fails. The blood pressure is very high. Bronchitis, defective vision, dyspepsia, are all evidences of the general strain on the other systems. Ultimately, if the patient does not die of cerebral haemorrhage, he may rapidly fail owing to weakness of the heart or to uraemia. Long before these signs have shown themselves, however, the patient has had early warnings and they are too frequently neglected. The nurse should understand that when a middle-aged, active patient complains of fatigue, or shows it by unusual irritability of temper (a marked symptom of chronic nephritis), or when he complains of headache, increased thirst and frequency of micturition especially during the night, there is a strong likelihood of early interstitial nephritis and it is time to take active steps to counteract it. The unfortunate thing is that the type of sufferer is usually one who objects to all restriction and is thus constantly in a vicious circle.

Treatment.—Quiet and care may sum up efficiently the general treatment of chronic interstitial nephritis. The parenchymatous variety should be dealt with as a form of acute nephritis. The interstitial condition is much more difficult;

there is no need to keep the patient in bed but it is very difficult to make him realize that he has got to slow down all his activity of mind and body. Circulation being poor, the clothing next the skin should be warm and woolly, and at night bed stockings may have to be worn and plenty of heat applied by hot water bag. Massage and warm baths assist the excretion through the skin. A light diet is most satisfactory. Proteins are usually limited, but in some cases in which oedema is persistent and there is a large quantity of albumin lost in the urine, an effort is made to reduce this loss by giving a high protein diet (see also Section VIII). The bowels should be kept fairly loose by giving salines first thing in the morning, and now and then 1 to 2 grains of calomel at bedtime. The great aim should be to take every possible element of load from the body. Bland fluids are of great help in diluting the waste products in the blood. Bright company, free of excitement, an interest in some simple hobby, moderate exercise and general reduction of mental and physical wear and tear will do more good than drugs, most of which are prescribed in order to relieve secondary symptoms, it being known that fundamentally the disease is incurable. Blood-letting, leeching, the giving of nitrites and many other measures may be necessary when complications threaten. The nurse in charge has a great work to do. Tact and patience often succeed when drugs fail.

Pyelitis

The description of this disease is found in the Surgical Nursing Section of this work (Vol. IV, Section X).

Treatment.—The causative organism must first be ascertained. For this purpose a sterile catheter specimen of urine is sent to the laboratory. The *Bacillus coli* is the commonest form of infection and will usually respond to sulphonamide therapy. The danger of crystallization of the drug in the tubules of an infected kidney is a real one, therefore, 5 to 6 pints of fluid must be taken in 24 hours. The tablets are crushed and given in an alkaline mixture (20 grains of sodium bicarbonate and 20 grains of sodium citrate in an ounce of water) since alkalinity reduces risk of crystallization. (See also Section VII.) Any obstruction (e.g. stone in the urinary tract) is a contra-indication to the use of sulphonamides.

Penicillin is sometimes used in staphylococcal pyelitis.

Mandelic acid is prescribed when the above forms of treatment are unsuccessful or when there is recurrence of the infection. By this treatment the urine is made strongly acid (*p*H [hydrogen ion concentration] more acid than 5·5) in which medium most organisms find it difficult to survive.

Cystitis

Inflammation of the bladder may be the result of various infections. It is a common complication of many pelvic diseases. It may be that the nature of the transitional epithelium of the bladder lends itself to chronic inflammation, but it is well known that cystitis is the bugbear of the nurse and the doctor. Once it becomes established it is very difficult to get rid of and it wears the patient out. The causative germs may reach the bladder from the kidney via the ureter, or they may be introduced from the outside by the urethra—a very common cause especially in women, the culprit very often being a dirty catheter.

Symptoms.—The acute variety is characterized by severe burning pain in the bladder region, radiating to the perineum and the inside of the thighs, passage of blood and pus in alkaline or acid urine and a most irritating frequency of micturition.

Chronic cystitis is often the result of long-standing kidney disease or it may persist after an acute attack. It may be associated with uterine displacement, with stone in the bladder, or with tuberculosis and malignant growths. These diseases may therefore be under treatment when cystitis occurs as a complication. The frequency is more irritable and burning than painful and it is apt to demoralize the patient, who becomes very tired of the constant micturition and the offensive, alkaline cloudy urine, full as it is of debris and pus. In some cases an acid urine is passed and the *Bacterium coli* is found.

The great danger is spread of the condition to the kidney, in which region pyelonephritis is a dangerous complication.

Treatment.—This depends upon the nature of the urine. An acid urine may be dealt with by giving urotropine, and there are numerous other proprietary drugs of value. An alkaline urine usually responds best to irrigation with weak antiseptics such as saline or boracic lotion. Vaccines have had variable success. Sulphonamide treatment has been used with success, especially in *Bacterium coli* infections. Some surgeons recommend opening the bladder and washing out for several weeks through a suprapubic incision. The diet should consist of fluids of a bland nature, including plenty of milk. No heavy proteins should be taken.

Uraemia

Uraemia is a form of toxaemia, but so far the exact nature of the process has not been determined. We already know that it is likely to occur as a terminal incident of advanced kidney disease, owing to the accumulation of harmful waste products in the blood. Various theories have been advanced to explain its

occurrence, some authorities postulating that the convulsions are a result of oedema of the brain. For the present, however, we must be content with the observation that when urine becomes scanty or absolutely stopped (anuria) the accumulation of the poisons in the blood causes the following symptoms.

Symptoms.—1. *Premonitory:* Headache; vomiting; lassitude; somnolence; irritability of the muscles, especially those of the face; temporary blindness.

2. *Active:* Convulsions like those of epilepsy; one fit may follow another, or there may be only one fit; there are degrees of spasm and tremor of the muscles; a state of coma (unconsciousness) is common after the fits; there is delirium in severe cases, then collapse and death. Cheyne-Stokes breathing is typical.

Treatment.—If the treatment is drastic and given in time there may be good hope of recovery. Patients may live for many years after a uraemic fit. Hot packs, hot air baths, strong purges and injection of pilocarpine nitrate may ward off a threatened attack. Sometimes chloroform is given when the convulsions are severe; while the patient is under the anaesthetic a certain amount of blood is drawn off or a lumbar puncture performed.

From what has been said about the dangers of anuria and of reduced amount of urine, it is obvious that the nurse in charge of any kidney case should be on the look out for uraemia. The slightest manifestation of it should be responded to by drastic treatment as outlined above.

Other Medical Diseases of the Urinary System

Hydronephrosis.—Obstruction to the outlet of the pelvis of the kidney by stone, disease or stricture usually results in a great enlargement of the pelvis, the pressure causing atrophy of the kidney tissue proper. The chief symptom is the passage at intervals of large quantities of watery urine. The swollen and heavy kidney causes pain and discomfort, relieved by the passage of urine. In the absence of serious symptoms it is wise to leave things as they are, but provided the remaining kidney is in good condition, it may be advisable to remove the affected kidney by surgical methods.

Floating Kidney.—This may occur in young females as a part of a general laxity of the suspensory apparatus of the kidney, and usually is found when there is also the condition of enteroptosis (pendulous condition of the viscera) including the transverse colon and the uterus. The symptoms are usually those of dull dragging pain over the kidney regions, increased when the patient has had a lot of standing to do. There may be a strong neurotic tendency and attacks of colic (Dietl's crisis)

may arouse suspicions of renal calculus; these attacks are probably due to kinking of the ureter, collection of urine in the pelvis of the kidney and pressure. Generally the treatment is that of massage and exercises adopted for the general condition. Nurses are advised not to tell their patient if they even suspect floating kidney, otherwise it will lead to a prolonged period of worrying and anxiety. Surgical treatment is sometimes successful. General tonics usually have a better effect.

CHAPTER 6

DISEASES OF THE NERVOUS SYSTEM: SYMPTOMS AND CLASSIFICATION

GENERAL FEATURES. LOSS OF POWER OF MOVEMENT. SPASM. CONVULSIONS. ATAXIA. REFLEXES. GAIT. LOSS OF SENSATION. BLADDER FUNCTION. INCONTINENCE OF FAECES. COMA. CLASSIFICATION OF NERVOUS DISEASES.

THE nervous system is the great coordinating system of the body. Without its governing power we should be unable to carry out the functions of the various organs and tissues. This is proved when anything goes wrong with a nerve, whether it be diseased or injured. The condition of paralysis of muscle ensues when there is damage to the motor tract of a nerve, and of impairment or loss of sensation when the sensory tract is involved. In nearly all cases both departments suffer, therefore in most nervous diseases we have to deal with signs and symptoms depending upon the double involvement of motor and sensory tracts. A nervous disease may be found anywhere, from the cortical cells of the cerebrum to the endplates on the muscle or skin; it will be realized therefore that there is a huge field of available tissue and naturally there are many very difficult and very intricate types of nervous disease.

Within the past 20 years there has been a growing realization of the intimate association of neurology with mental disease, psychiatric or pyschological. It may be possible soon to reclassifiy many nervous diseases and to reorganize some of our ideas on the subject generally but until greater developments occur it is wise to stick to established principles.

General Features

In order to understand the signs and symptoms of nervous disease, it is necessary first to have a knowledge of what goes on when any portion of the nervous system is abnormal. As a general rule there are the following main changes in power or sensation or in the state of the tissues.

Loss of Power of Movement.—Total or partial loss of power of movement is spoken of generally as paralysis or motor paralysis.

The individual muscle fibres lose their power of contractility or alternatively are held in a contracted condition so that for all practical purposes the muscle fibre is not able to lengthen and shorten at will. When thousands of fibres are together involved the paralysis may affect an entire muscle; as a general rule, indeed, several muscles in a group become paralysed at the same time and we have the condition of loss of power in a limb or limbs. The extent of the paralysis depends upon the amount of disease or injury affecting the nervous tissue. From what we already know of the cramped pathways of the brain, pons, medulla and spinal cord, however, it is easy to see that a very small defect in any of these places may have widespread results in the muscles, and this always makes nervous disease very important.

Various types of paralysis are recognized. For example when there is a lesion of the brain, the paralysis is confined to one side only and is known as hemiplegia. When there is disease of the spinal cord, however, the effect is known as paraplegia. If one limb only is affected we say that it is monoplegia, when two limbs, diplegia.

As stated above there are 2 ways in which muscle paralysis may demonstrate itself in a limb or limbs. In the first condition in which the muscle fibre is flabby and lifeless and muscles generally are likewise soft and flaccid, the lower motor neuron is the site of the damage; this type is called flaccid paralysis; the main features are loss of reflex action, wasting and even degeneration of muscles. In the second condition the muscles are in a state of firm contraction known as spasm; such type is known as spastic paralysis and is characterized by increased reflex action, rigidity and difficulty in movement; in this case the upper motor neuron is affected. Both types may be commonly found.

Spasm.—As we have remarked above, a bundle of muscle fibres which remain contracted or which contract and expand against the will of the person affected, is said to be in a condition of spasm. The origin of this unusual state is irritation of the nerve running to the muscle, usually from disease but now and then from poison. For all practical purposes we may regard it as a relaxation of the bearing rein allowing the horse to have his head. When the spasms are continuous the condition is known as tonic spasm; if, however, there are intervals of relaxation, however short, the condition is known as clonic spasm.

Tonic spasm may result from interference with any part of the motor tract, and therefore it occurs as a feature of haemorrhage of the brain and of diseases of certain areas of the spinal cord, but nerve poisons such as those of tetanus (lockjaw), strychnine and similar substances may also cause the same condition. For instance, there is a rigidity associated with cerebral haemorrhage

which is of 3 types: 1. that due to the initial irritation of the brain cells by the blood; 2. that due to the process of healing going on; and 3. that due to the activities of certain tracts which are free to act in the absence of stimulation from the damaged nerve fibres. In the last case the rigidity comes on after a few weeks and when there is evidence of permanent hemiplegia, whereas in the first two cases the rigidity is early and may clear up completely. Ultimately there may be permanent contraction of the muscles, due to degeneration of the muscle fibres themselves. It is apparent that there are thus several states of rigidity and contracture depending upon the type of lesion and this accounts for the variability of the symptoms found in diseases such as disseminated sclerosis and lateral sclerosis of the cord. Tonic spasm may be a feature of one phase of a convulsion (see below).

Clonic Spasm.—In the case of clonic spasm small groups of muscles may show active and rapid alternation of muscle contraction and relaxation. One limb may be put into a state of involuntary flexion and extension, but generally the whole frame participates and the condition is very alarming.

Convulsions.—These have been discussed from the first-aid point of view in Vol. I, Section II, Chapter 6. A fuller explanation may be given now. Convulsions or fits are abnormal nervous states in which there may be present both tonic and clonic convulsions and in which consciousness may or may not be lost. The best known examples are the convulsions of children (common in rickets and other evidences of improper dieting), tetanus, uraemia, strychnine poisoning, hysteria and above all, epilepsy. Taking the last as a typical example, there is first the tonic stage, in which all the muscles are rigidly contracted, and then the clonic stage, in which there is violent activity of all the limbs. Unconsciousness is complete from the beginning, and the fit is followed by a variable period of semi-consciousness. It is difficult to say when a state of involuntary muscle spasm or period of unconsciousness is a convulsion; it is perhaps best to regard even the very mild varieties of these abnormal conditions as convulsions of minor type and the classification is thus a matter of degree.

Ataxia.—Ataxia is one of the most prominent evidences of nervous disease. It is due to the incoordination of action of muscle groups. Normally as we know already (see Vol. I, pp. 267–268) efficient movement of the muscles depends upon perfect harmony—a kind of " understanding " between the various groups. Disease of nervous tissue is apt to upset the harmony, which is dependent not only upon the perfect adjustment of one muscle action to another, but also on the influence of the cerebellum and on the afferent impressions received from the eye and the

ear. There is a loss of what is known as muscle sense. The person who suffers from ataxia may not be able to place his feet with confidence on the ground; he may have difficulty in touching with his index finger small articles placed in front of him.

Reflexes.—As described in Vol. I, pp. 268–269, reflex action is an intrinsic factor in refined movement. Any disease which interrupts the course of the reflex arc is therefore likely to show marked signs. If we stick to the idea of the brain sending down a bearing rein to hold in check these actions, we can understand that when the rein is relaxed the actions are made more responsive to stimulation and this is proved by experience. The knee jerk is one of the commonest tests in neurology; in this the patellar tendon is tapped with the fingers or with a special hammer (Fig. 64) at a point just below the knee cap. Normally there

Fig. 64.—Percussor.

(By courtesy of the Surgical Manufacturing Co, Ltd., London.)

should be a fair response by the leg, which gives a characteristic kick. If there is any relaxation of the bearing rein, e.g. by disease of the upper motor neuron, the reflex will be increased. If the disease is any part of the reflex arc, the reflex will be absent. The following reflex tests are commonly carried out in addition to that of the knee jerk: the jaw jerk, elicited when the relaxed lower jaw is tapped over the middle of the chin; the biceps jerk and the triceps jerk, produced by sharp tapping over the tendons of these muscles at the elbow; the Achilles jerk, demonstrated by tapping the back of the ankle just above the heel.

There is a group of reactions obtainable only in disease, two tests being outstandingly in use. Ankle clonus is a to-and-fro vibration of the foot resulting from sudden pressure applied to the ball of the toes, while the calf muscles are supported by the hand; knee clonus is a vibration of the patella, elicited in disease when the patient lies on his back with the leg straight out and relaxed while the examiner gives the patella a slight jerk which sets up the clonus. Another group is that of the superficial reflexes, which are demonstrated as slight muscular responses, say in the abdominal or epigastric regions, when the skin is stroked by the finger. The most interesting of these, however, is the plantar reflex. In all those who have learned to walk, stroking of the sole of the foot causes a flexion of the foot and even a drawing

upwards of the leg; in babies and in those who have certain nervous diseases a similar stimulation causes marked extension of the great toes. This is known as Babinski's sign, and in adults it is almost always due to disease of the motor nerve path.

Gait.—Two well-marked types of walking are distinguished in advanced disease of the spinal cord. The first is known as the ataxic gait and has been referred to above. The patient is unable to stand steadily when his two feet are close together. When he tries to walk he aims at having a large base to operate on, therefore he throws his feet out, but even then he is uncertain and he has to use his eyesight to correct the tendency to "seek" with his feet for the ground. When he does put his feet down, they are stamped on the ground in prancing fashion. If he were to close his eyes he would almost certainly fall down. In this case, as might be imagined, the knee jerk is lost.

In the case of the second type of abnormal gait, viz. the spastic gait, the upper motor neuron being affected, the patient is easily sent into spasm and therefore the gait is a slow, tremulous and restricted type of jerky walking. There is usually some flexion of the knee and ankle and in severe cases the well-known scissors deformity of the thighs, which may be crossed owing to the strong contraction of the adductor group. The right foot is usually put out boldly but the left is dragged after it with the top of the toes scraping over the ground. In this type the knee jerk is increased in intensity.

Loss of Sensation.—Pain, touch and temperature sense may be entirely lost. We speak of anaesthesia when there is loss of touch sense and of analgesia when there is loss of pain sense. Both are very important, as pain and touch are our shields against damage to the body and we can imagine that when our signal system is destroyed the body is at the mercy of the environment, since there is no method of calling up the reactive powers. Touch sensation can be tested by using a small piece of fine cotton wool and going carefully over the suspected area, noting the points at which the patient does not feel the gentlest contact. In some cases hyperaesthesia (increased sensitivity to touch) is found. Pain sensation is lost in many advanced cases of cord disease and it is by no means a blessing in these cases to have freedom from pain. The method of testing is that of using a large blunt-pointed needle; many diseases are characterized by hyperalgesia, the pain being excessive even on the lightest touch. Loss of the temperature sense can be tested by placing over the area affected the ends of two test-tubes, containing respectively hot water and ice. The muscle sense, one of the most difficult to assess, is tested by giving the patient articles of

certain weight and shape and asking him to close his eyes and estimate their qualities as accurately as possible.

Bladder Function.—Loss of control of the bladder occurs completely or partially when there is injury to the spinal cord above the vesical centres. The following types of incontinence may be found.

Distension.—The bladder frequently goes on filling until it empties by reason of the great pressure exerted on the sphincter muscles of the bladder outlet (overflow incontinence). Usually, however, the case is carefully watched and catheterization is done at intervals, the urine being removed with the usual precautions by a rubber catheter. The bladder may also be drained by tying the catheter in and allowing the urine to drain steadily.

Simple Incontinence.—In this condition the urine dribbles all day and night.

Reflex Incontinence.—The bladder fills up to a certain point, then the urine is passed involuntarily. It is a very troublesome complaint for the patient, especially as the cure is rare.

Incontinence of Faeces.—This is not so common as bladder incontinence, but when it does occur it means a great deal of extra work for the nurse, since the patient is like a baby requiring constant attention and the skin of the buttocks is often broken. All precautions should be taken to ensure that the area in the vicinity of the anus is kept clean and antiseptic. If the stools are liquid and the tone of the rectum completely gone it is a very difficult problem, but usually when the diet contains enough cellulose, the faeces can be thickened; they then collect in the rectum and are removed twice a day by enema.

Coma.—The condition of coma is fully described in Vol. I. Section II, Chapter 6.

Classification of Nervous Diseases

Before going on to the discussion in the following chapter of the main nervous diseases, it may be advisable to have some table upon which to base our studies of the various lesions of the brain, spinal cord and nerves. It must be realized that disease of the nervous system can rarely be localized unless it is acute and definite. As a general rule the signs and symptoms of established nervous disease, which usually becomes chronic after a time, are those of the neuron affected, therefore brain and spinal cord are involved or the cord and the nerves, sometimes all three. In the following table the diseases are classified according to their outstanding characteristics.

TABLE SHOWING CLASSIFICATION OF NERVOUS DISEASES

(A) ORGANIC.

Cerebral.	*Syphilitic.*	*Spinal Cord.*	*Nervous.*
Meningitis. Apoplexy. Abscess. Neoplasm. Little's disease. Paralysis agitans. Encephalitis. Hydrocephalus.	Locomotor ataxia. General paralysis of the insane. Syphilis of brain. Syphilis of cord.	Meningitis. Myelitis. Spastic paraplegia. Disseminated sclerosis. Progressive muscular atrophy.	Neuritis. Diseases of and injuries to individual nerves.

(B) FUNCTIONAL.

Neuralgia.
Migraine.
Tetany.
Convulsions of children.
Epilepsy.
Chorea.
Hysteria.
Neurasthenia.

As mentioned previously, the above classification is based on what may be regarded as old-fashioned lines, but it will serve as a basis for the study of the various diseases mentioned.

CHAPTER 7

DISEASES OF THE NERVOUS SYSTEM: ORGANIC DISEASES

CEREBRAL GROUP. MENINGITIS. APOPLEXY. CEREBRAL ABSCESS. NEOPLASMS. INFANTILE PALSIES. PARALYSIS AGITANS. ENCEPHALITIS. HYDROCEPHALUS. DISEASES OF SYPHILITIC ORIGIN. LOCOMOTOR ATAXIA. GENERAL PARALYSIS OF THE INSANE. SYPHILIS OF THE BRAIN OR SPINAL CORD. DISEASES OF THE SPINAL CORD. MENINGITIS. MYELITIS. SPASTIC PARAPLEGIA. DISSEMINATED SCLEROSIS. PROGRESSIVE MUSCULAR ATROPHY. DISEASES OF THE NERVES. NEURITIS. MULTIPLE OR PERIPHERAL NEURITIS. DISEASE OF OR INJURY TO AN INDIVIDUAL NERVE.

Following the chart given at the end of the previous chapter we divide the nervous diseases into two great groups—organic and functional. Organic disease of the nervous system means that there is something intrinsically wrong with the structure of the nerve tissue; functional disease means that although there is no evident defect of structure there is undoubtedly defect of work done. We shall take the organic group in order according to whether the origin of the disease is in the brain, in the blood as the result of syphilis, in the spinal cord, or in the nerves.

Cerebral Group

Meningitis.—Apart from cerebrospinal meningitis, commonly known as spotted fever, and dealt with as an infectious disease (see p. 397), there are two main causes of inflammation of the fine membrane which covers the brain. The first is tuberculosis and the second is a non-tuberculous cause, i.e. the result of an invasion of the meninges by some other infective organism. In the former case it is the base of the brain which is usually affected; in the latter case it is the outer covering of the dome which is the site of the disease.

Tuberculous meningitis is part of the general infection of tuberculosis, fully dealt with later. It is commonest in children, and is usually secondary to some focus elsewhere. The symptoms are slow development of pain in the head, irritability and

vomiting, lasting up to a month. This state gradually becomes intensified; we are then presented with the picture of the irritative state, in which the child is dull, fevered and troubled with irregular vomiting. He occasionally utters the typical shrill cry associated with the disease and he may grind his teeth. The stiffness of the muscles of the neck causes a characteristic retraction of the head, so that the patient appears to be boring his pillow with the occiput. On the abdomen the tight muscles produce the scaphoid or boat-shaped abdomen. The eye signs are unmistakable. The eyeballs are very prominent and there is usually marked squinting, with unequal pupils; vision is partially lost. If a small scratch is made with the fingernail on the skin, a red wheal appears very soon; this is known as the *tache cérébrale*. The pulse is very slow and often irregular. Ultimately the dangerous compression stage is reached. Convulsions are common in children, these ushering in the terminal stage of coma, which is accompanied by rapid, irregular weak pulse and finally death in 3 to 6 weeks after the first signs.

Suppurative Meningitis.—In many respects this type is the same as the above. It may follow the infective fevers (including pneumonia), or local abscess, e.g. mastoid disease following a suppurating ear. It is undoubtedly a serious condition and the onset may be very sudden. Vomiting unassociated with food is one of the danger signals of meningitis occurring in the course of any of the above diseases. The irritability rapidly passes into delirium (or convulsions in a child) and finally to coma and death.

Treatment.—The nursing is very exacting, the patient being always extremely ill and requiring constant attention. A rubber or air bed (Vol. II, pp. 312 314) should be used if at all possible, since bedsores are likely to develop in a short time as the result of incontinence and rapid wasting.

Nasal feeding is instituted when the patient is unconscious and should consist of thin "Benger's Food," strained egg and milk or anything else which is high in nourishment value. The mouth hygiene is very important. The bowels are best controlled by giving an enema daily. Intracranial pressure is relieved by injecting 4 ozs. of 50 per cent magnesium sulphate into the rectum slowly as a retention enema. This, however, should not be done over a long period as it is irritating to the bowel membrane.

Medical treatment has made great advances during the last 10 years. The causative organism is first determined by means of a lumbar puncture and vacteriological examination of the cerebrospinal fluid. Treatment by sulphonamides has been successful in meningococcal, streptococcal and pneumococcal meningitis, but the pneumococcus is more sensitive to

penicillin, which if injected early in the course of the disease, gives a good hope of cure. Systemic penicillin is of little value in these cases. It must be given intrathecally, i.e. directly into the subarachnoid space. Sometimes the skull is drilled and penicillin injected into the lateral ventricles.

Tuberculous meningitis unfortunately does not respond satisfactorily to any known treatment. The use of streptomycin is still in the experimental stage.

Apoplexy.—The first-aid treatment of apoplexy has been discussed, but at this point the complete study of the disease must be made. First of all it would be well to clear up certain points in the nomenclature. Apoplexy is actually the fit which is the result of haemorrhage into the substance of the brain. This is also known popularly as a " stroke " or a " shock." In certain diseases the results obtained by the sudden bursting of a small artery may also be found when there is closure of an artery due either to clotting (thrombosis) or to blockage (embolism) in a certain part of the brain. The most commonly affected vessel is one of the small branches of the middle cerebral artery, therefore there is interference with the motor path passing through the brain, with subsequent paralysis of one side, and interference with speech—the well-known condition of hemiplegia. From the above we see that apoplexy is only part of a disease of the arteries, but it is best to study it as a nervous disease. The nurse would be well advised to revise the anatomy and physiology of the nervous system (Vol. I, pp. 244–269), refreshing her memory regarding the course of the motor fibres from cerebral cortex to muscle. She will then fully appreciate why it is that injury of the right side of the brain by haemorrhage is accompanied by paralysis on the left side of the body and vice versa.

Causes.—People with arteriosclerosis become affected with a brittleness of the arteries. These arteries may burst at various points, as we already know, but it seems fated that one of the commonest points should be the internal capsule of the brain through which pass the densely packed fibres going to the spinal cord. The pressure of the liberated blood, the injury to the brain tissue and the changes which occur during the healing process, all have certain effects which make up the picture of the state of hemiplegia, which is properly the nervous aspect of the disease. Men over 40 who have led strenuous lives are most commonly the victims. Excess is the word which covers most of the causes in this category. In the case of a small embolism, it is quite clear that if a tiny vegetation from one of the valves of the heart becomes stuck in one of the branches of the middle cerebral artery, there will be softening and degeneration of the brain tissue very soon afterwards and the symptoms, very like those of cerebral haemorrhage, are associated with

valvular disease of the heart in young people. In thrombosis the arteries have degenerated, either from wear and tear or from syphilis, and therefore old and young may be affected. There is usually ample warning in the form of mild dizzy seizures and occasionally convulsions. The symptoms are less dramatic, the onset of the hemiplegia often taking some time. The patient is often conscious.

The main thing to remember about all 3 lesions is that in effect the brain substance is starved, becomes degenerated and ceases to perform its functions; the motor fibres cannot send their messages to the muscles; paralysis is the result.

Symptoms and Signs.—In the serious haemorrhages or in embolism a sudden onset may be looked for, but in thrombosis the patient may have a few hours as a warning period, during which there may be some difficulty in speech, abnormal sensations in the limbs and stiffness of the muscles on one side. Ultimately the condition of hemiplegia becomes fully established. In the case of the commonest type of apoplexy, viz. the sudden "stroke" due to the rupture of one of the branches of the middle cerebral artery, the symptoms are produced generally as a result of some sudden effort—running after a bus, climbing a stair, the taking of too heavy a meal or having a bout of coughing. In some cases fright or great emotion, including an outburst of temper, may precipitate an attack. Apoplexy is not often an event of the night; it seizes those who are busy with their daily duties. For this reason the first-aid treatment is very important.

The first sign of an apoplectic fit is headache, followed by giddiness and a state of unconsciousness. There may be convulsions but usually the patient collapses in a confused heap. When examined he will be found to have lost the power of the arm and leg of one side, the cheeks will sag markedly and they will puff in and out with each breath. The face is usually very flushed and the breathing is of stertorous type. The pupils are dilated and unequal. The pulse is full and of great tension. It may be that there is temporary loss of both bladder and bowel control. It must not be forgotten that death may occur in such a seizure. Usually, however, there is partial or complete recovery from the first or even the second attack, and as the patient emerges from the condition of shock we see the development and establishment of the condition of hemiplegia.

Hemiplegia is the result not only of the initial haemorrhage, but also of the degenerative and recuperative processes which follow, as stated in the previous chapter. Hemiplegia may also result from inflammatory conditions, from fractures of the skull and from the presence of tumour, and there is an imitative variety which has been found in hysterical people. For all practical purposes, however, it may be regarded as a sequel of

cerebral haemorrhage, embolism or thrombosis. As the patient recovers from the initial shock he is restless, tries to speak and to move the paralysed side and is generally distressed. The arm and leg of the affected side, when picked up and allowed to drop, fall down with a lifeless thud; all the tone is absent from the great muscular groups. The leg is usually more seriously affected than the arm. After a day or two there is observed some rigidity but this passes off; then there begins the slow process of recovery (if there is to be recovery) which in the later stages may be characterized by spasm of the affected limbs. It is a trying period for the patient and nurse. The helpless condition of the patient, the tendency to bedsores, the need for keeping the muscle tissues in satisfactory condition and the difficulties of eating are all negative factors. When the patient begins to walk about there is the typical one-sided gait, with the affected leg shuffling along after the other and the affected arm flexed on the chest. In some cases the flaccid state persists, but both present the same difficulties. Recovery may be partial, but often the patient is left with contractures, spastic movement and a tremulous condition of the limbs.

Treatment.—The immediate treatment of apoplexy is the first-aid treatment. The patient must be disturbed as little as possible and the sooner he is in bed at home or in the hospital, the better. The main points to remember are that the head and shoulders should be slightly raised, while cold water cloths or ice should be applied to the head. Once the patient is in bed the shock must be dealt with by ample blankets and hot water bottles. Two drops of croton oil may be put on the back of the tongue, or 4 grains of calomel may be given in the same way. It is well to make sure that these drugs do not escape with the dribbling saliva, as it is essential in order to reduce the blood pressure that brisk purging should be encouraged. Many doctors perform venesection at once. Absolute quiet and rest are needed; neither brandy nor whisky should be given.

As time goes on and the patient recovers partially, he becomes more difficult since he constantly wants to do things he ought not to do and the nurse may have her work cut out for her if she is going to succeed in keeping him quiet. The urine may have to be withdrawn by catheter and enemas may be necessary; above all, owing to the flabby and toneless condition of the muscles there is the constant menace of the bedsore. Many hemiplegics are therefore nursed on an air bed or water bed from the start. Nasal feeding should be instituted during unconsciousness. Spoon feeding is dangerous owing to the risk of inhaling the fluid. Unless the patient is constantly changed in position he runs the risk of the development of hypostatic pneumonia, a condition resulting from congestion at the bases of the lungs.

In the later stages massage and gentle movements of the muscles and electrical treatment may be necessary in order to maintain the life in the muscle fibres. The affected limb should be splinted to prevent the development of contractures and deformity, and a bed cradle should be used to support the weight of the bedclothes. The various complications must be dealt with as they occur. We cannot expedite the progress; we have to resign ourselves to making the best of a bad job and the helpless condition of the patient makes the nursing of the case very heavy indeed.

Aphasia.—It may happen as a result of involvement of the speech centre on the left side of the brain, with accompanying paralysis of the right side of the body, that speaking, reading or writing may be interfered with, apart from the difficulties associated with loss of muscular power. The patient loses his coordination of the auditory and visual centres with the motor centres, and thus according to the area affected we may find motor aphasia (loss of power of expression by speech), or agraphia (inability to make expression by writing) or alexia (the printed word means nothing) or word deafness (the patient hears sounds but they do not convey anything to him). All these signs have nothing to do with the original difficulty in talking, which is the result of flabbiness of the lips and cheeks and a certain loss of power in the tongue. They become apparent when the power returns to the muscles, and present us with the very intricate problem of working out the site of the defect and of re-educating the patient to his environment, often a thankless and unsuccessful job but full of the greatest interest to the nurse who may be minded to help with the work.

Cerebral Abscess.—Abscess of the brain is a very serious condition. It most frequently arises as a result of abscess in the middle ear, which spreads to the mastoid process and so to the temporal lobe, but abscess may occur anywhere as a result of wounding or as a secondary deposit of bacteria from some other virulent focus in the body. Rigors, vomiting and pain, and later compression symptoms not unlike those of meningitis, lead to coma and death unless radical surgical measures are adopted and these are often impossible when the abscess is at a vital area of the brain. The outlook is very bad.

Neoplasms.—Tumours of the brain may consist of various elements: tuberculous, syphilitic, nerve tissue (gliomata), carcinoma, sarcoma, cysts and innocent tumours. The classical signs are headache, vomiting and neuritis of the optic nerve, but eventually convulsions, dizziness and lack of mental acuity lead to a fatal termination. Medical treatment may be applied to the syphilitic condition, when injections may succeed. Recent

surgical advances have made it possible to remove certain brain tumours with successful results.

Infantile Palsies.—The brain of an infant may be defective owing to disease of the mother; the child is born with a diseased brain. Again there may be injury to the head at birth or serious inflammation in early childhood. In many cases it has been proved that syphilis is the cause. Hemiplegia, cerebral diplegia (Little's disease) and paraplegia are common types, Little's disease being most frequently found. Hemiplegia shows the usual evidences of contractures, tremors and paralysis. Little's disease generally results from some pressure on the child's head during birth, as a result of which there has been haemorrhage of the meninges. In the end the child presents a typical picture of double rigidity, contracture and paralysis of the legs with so much spasm of the adductor groups that the legs are crossed in the typical "scissors deformity." The arms are not so seriously affected, but the fingers are constantly moving in "pill-rolling" fashion—the state known as athetosis. All the reflexes are increased and the child is in a very jerky state. Unfortunately there is usually some mental involvement and even after many years a type of epilepsy occurs. These patients may live for a long time, but they require to be specially treated and educated in special schools where orthopaedic measures can be used to relieve the contractures.

Paralysis Agitans.—This is known as Parkinson's disease, and it may often be seen if a careful watch is kept on old men and women in the street, because the gait is characteristic. The patient appears to be falling forward, but he always gives a short run and appears to catch himself up in time. If more careful and closer scrutiny were made, however, it would be found that there were marked tremors of the hands and considerable nodding of the head, while the staring eyes and the expressionless face would be found fixed in the classical Parkinson's mask. Speech may be slow to begin with, but gradually quickens. Athetosis is a feature of the disease. Treatment is not of much avail, especially when the patient is old. Tonics and electrical treatment merely help the general condition.

Encephalitis.—The modern and well-known condition o encephalitis lethargica, or "sleepy sickness," dealt with in the infectious diseases group (see p. 399), is to be distinguished from the simple encephalitis, which may take a haemorrhagic or suppurative form, and may be local or widespread. The signs and symptoms are very like those of meningitis but paralysis of the eyes and a difficulty in walking are outstanding.

Hydrocephalus.—This disease is characterized by the presence of a huge skull which seems to make the forehead stand

out; the face becomes comparatively diminished. Cases have been known in which the skull has measured over 30 inches in circumference. The causes are 1. congenital, in which there are usually also associated certain other defects of the spine; 2. acquired, as a result of a tumour pressing on the veins; 3. idiopathic ("water on the brain"), as the result of a great effusion of serum into the ventricles. The congenital type is commonest and may cause great difficulties at birth. The sutures are ununited and ossification is incomplete. As a result of the pressure upon the brain, the convolutions are flattened and a general mental and physical degeneration of the body takes place; convulsions and blindness usually lead to coma and death, children rarely living beyond the age of 7. Attempts at puncture of the ventricles are successful for about a fortnight, but the fluid quickly collects again.

In microcephaly, the opposite condition, there is a comparatively small head owing to the fact that the crown of the head fails to grow. Idiocy and general mental weakness are associated with the condition.

Diseases of Syphilitic Origin

Locomotor Ataxia.—Of all the nervous diseases, locomotor ataxia, which is also known as tabes dorsalis, is outstanding because of its distinctive signs. There is usually very little difficulty in recognizing this disease.

Causes.—It has been soundly established that the only cause of locomotor ataxia is syphilis. The organism responsible, the well known spirochaete of syphilis, may be isolated from the affected nervous tissues themselves; the signs and symptoms are thus direct results of the destruction of the vital stations on the afferent nervous tract. Examination of the cerebrospinal fluid also proves the affection to be active in the spinal cord, since a positive Wassermann reaction, the standard test for syphilis, is given. Locomotor ataxia belongs to the group of diseases which comprises the tertiary stage of syphilis, and may come on as long as 15 years after the primary stage. Males are more affected than females, and it is common at the age of 40. Predisposing causes are excesses of all kinds (which usually form part of the life of the patient), an injury to the spine or squalid conditions of life, including exposure. On microscopical examination of the posterior nerve roots and of their associated ganglia, there is found to be an ascending degeneration, which may affect the main afferent tracts of the posterior part of the spinal cord. Ultimately the disease may reach the brain centres.

Symptoms.—Although it is customary to divide this disease into 3 groups, viz the early or pre-ataxic stage, the stage of loss of

coordination or ataxic stage and the stage of paralysis, there is no definite dividing line between them; one set of signs and symptoms runs into another as the disease progresses. Common to all stages, however, are the symptoms of eye defects, sensory impairment and loss of coordination. Thus in the pre-ataxic stage we find that the characteristic lightning pains pass through the body; there are transitory tinglings or burnings of the lower limbs, which occur sometimes every 3 or 4 hours, often only once a day. Another characteristic symptom is called the girdle pain, owing to the fact that the patient has the sensation of being gripped by a vice; the area, usually the waist, is very sensitive even to the slightest stimulation. The toes may be numb. The knee jerk, which we referred to as being of great importance at the beginning of this Section, is absent. Some difficulty of bladder control is experienced. The eyes generally show evidences of partial paralysis or of atrophy of the optic nerve; the characteristic Argyll-Robertson pupil, which reacts to accommodation but does not react to light, usually belongs to this first stage.

In the second or ataxic stage, the patient fails to pass the standard Romberg test. If he is asked to stand with the feet close together and then told to close both eyes, he sways in all directions and may actually collapse. As time goes on the typical ataxic gait develops (see p. 301) and the patient has very great difficulty in walking unless he can see his way clearly. He is easily knocked off his balance. The numbness of the feet increases; very often the patient says he has the sensation of his socks being lined with cotton wool. The sensations of touch, pain and temperature are perverted, and this leads to all kinds of abnormal feelings. One of the most interesting and most important signs of the disease is the occurrence of crises, affecting the stomach, larynx, rectum or bladder and giving rise to a set of acute symptoms of pain in these regions, which may simulate other diseases. Depending upon the gravity of the case, these may continue for a few hours or a few days and they are very distressing. At the end of this stage of locomotor ataxia it may be noticed that the skin becomes shiny and dry; great disintegration occurs at the joints, often with painless swelling (Charcot's joint)and the bones become softened. There is often ulceration of the sole of the foot.

The paralytic stage is usually very trying, because by the time it is reached the patient's general health is very low and he has to take to bed. One trouble after another appears, the result of a state of affairs which can only be described as a progressive rotting of the tissues. Ultimately the patient, his case complicated by heart affections, cystitis, pneumonia or hemiplegia, dies a merciful death. The disease in all its stages may last for about 10 years—sometimes less, sometimes more.

Treatment.—From the doctor's point of view the approved anti-syphilitic treatment, so successful elsewhere, seems to be a signal failure in locomotor ataxia. When salvarsan or one of its allies is given there may be a slight temporary improvement, but as a rule we are forced to fall back on the old remedies like mercury. Neither penicillin nor the sulphonamides are much good. The nurse will find a never-ending amount of work. The helpless condition of the patient makes him a difficult subject, and the terminal symptoms demand all the nurse's energies and time. The best that can be hoped for in this fatal disease is the maximum comfort possible in the circumstances.

General Paralysis of the Insane.—This disease, which need not be studied in detail since it belongs properly to the subject of mental diseases, is the result of syphilis affecting the cortex of the brain. The meninges come prominently into the picture and since the disease is progressive, the body and the mind slowly become more and more deranged as time goes on. While in many respects this disease resembles locomotor ataxia, the early evidences are usually of a mental character and they may occur in people between the ages of 30 and 40. The exciting causes are very similar to those of locomotor ataxia and the spirochaete is present in the cortical area. In an advanced case there is great degeneration of the outer layers of the brain and its coverings.

Symptoms.—These appear so unostentatiously that a man of great business capacity may be allowed to go on with certain extreme policies, and catastrophes may occur before it is realized that disease is active. The conduct of a "G.P.I." subject is always interesting. He may be so dominating that he gets his own way, and since at all times his actions tend to excess he may be dangerous not only to himself but also to those who are dependent upon him. The emotional outbursts and the wild licence of the patient may necessitate his confinement to a mental hospital, where he can have full scope for the magnificent schemes propounded and engineered by a mind which is obsessed by characteristic delusions of grandeur. The physical side is like locomotor ataxia in its terminal stages, but to begin with the typical "G.P.I." patient shows difficulty with the speech muscles. Talking becomes a series of slurred utterances and there is usually tremor of the face. In time the writing becomes rather uncontrolled and finally the patient can only scribble like a child. Maniacal attacks alternate with melancholia; fits of epileptoid type occur; gradually paralysis and incontinence reduce the patient to the hopeless moribund state described under locomotor ataxia. The last stages do not come into the consideration of the general nurse, as the patient is almost invariably a lunatic. Death occurs in 2 to 5 years from the onset of the first signs.

Treatment.—Apart from the usual sedatives and the routine nursing care, there is a certain success in giving the patient an attack of malaria, either by allowing so many mosquitos to bite an area of the skin or by otherwise inoculating him with benign tertian malaria.

Syphilis of the Brain or Spinal Cord.—There are certain lesions of the brain dependent upon primary syphilis—arterial degenerations, syphilitic tumours (gummata) and degenerations of the tissues as a whole. Owing to the widespread nature of the disease, the symptoms are variable and depend upon the main aspect of the disease. Thus disease of the vessels may give rise to gradual hemiplegia and aphasia; a gumma may, by involvement of membranes and cells, lead to the occurrence of fits (Jacksonian epilepsy) and sometimes to paralysis of one limb. The cranial nerves may be involved, leading to paralysis of the eyes. In the last stages mental confusional states lead to complete dementia and death.

In the spinal cord syphilis there are pains, chiefly at the level of the affection, and we may expect bladder and rectal incontinence or incompetence, paralysis of limbs and exaggerated reflexes. There is more hope for the above types of syphilitic disease than for locomotor ataxia or general paralysis of the insane, and vigorous treatment by mercury, bismuth salts and iodides may have success. It is usually possible to abort the early disease and even if a cure be not effected the patient is at least much improved.

Diseases of the Spinal Cord

Meningitis.—The membranes surrounding the spinal cord may be inflamed without involvement of the coverings of the brain, thus a set of more or less localized symptoms is provided; but in time, when the disease spreads, the diffuse character of the inflammation may lead to many different reactions. The course of the disease may be rapid or slow. This disease must be dissociated from the common cerebrospinal meningitis, which is dealt with later as an infectious disease. There are various organisms responsible, and the factors of cold and injury must be borne in mind. The signs of acute meningitis are usually fever and a rigor to begin with, with pain in the back increased when the spine is pressed on by the finger. The usual stiffness of muscles is found. Paralysis is a common sequel, and recovery, which is rare, never takes place without some degree of nerve impairment demonstrated by sensory or motor defect of a permanent nature. The treatment is much the same as for the cerebral type of meningitis. In the state of chronic meningitis, there may be severe disease of the bones or of the cord and the meningitis is part of the whole picture. The outstanding signs

are various types of pain, chiefly of a radiating nature from the spine. Later on feeling is entirely lost and there is paralysis of the lower limbs. The treatment, like that of cerebral meningitis, may be summed up as absolute quiet, a darkened room, sedative drugs and the application of the icebag to the spine. Sometimes the bones have to be operated on. Dry cupping, hot packs and other antispasmodic remedies should be given in acute cases.

Myelitis.—Inflammation of the cord may be partial or complete so far as the grey and white matter of a certain area is concerned. The disease may be local or general, and there are various degrees of severity in the onset. It usually occurs in males, and may be the result of a micro-organism or of a poison in the blood. It is a common sequel of syphilis, chill and vertebral disease or injury, and it may be the termination of a long-standing condition of general debility. One of the great characteristics of this disease is its sudden onset; the patient may have little or no warning except a weary sensation in the feet; within a few hours he may be completely paralysed—this is the most acute type. As he lies in bed after the initial fever has passed off and left him without any power in his legs, the patient shows typical signs of paraplegia below the level of the affected portion of the spinal cord; above that level he is, to all intents and purposes, normal except for a small " ribbon " of acute sensitivity round his body separating the sound region from the affected region. The legs lie flaccid and the patient is quite unaware of their presence. Usually there is retention of urine and of faeces, but much depends upon the site of the myelitis. It is obvious, too, that if the disease is high enough up to destroy the phrenic nerve cells of the anterior horn, a fatal paralysis of the diaphragm may result. Gradually as the disease becomes chronic in the non-fatal cases, there is more and more destruction of grey and white matter, and the motor and sensory reactions all indicate that destruction of vital cells is going on. Sores appear on the skin, there are painful muscular contractures and spasms may be set up by merely touching the patient. The outlook is always bad and the nursing is heavy, a water bed being required and all the usual nursing measures of the paralysis case must be applied.

Spastic Paraplegia.—This is one of the uncommon spinal cord diseases. It is also known as lateral sclerosis, since it affects the anterior cerebrospinal and the lateral cerebrospinal tract. In effect, there is very little difference between the activities of spastic paraplegia and disseminated sclerosis, the latter often being considered the natural sequel of the former. The symptoms of weakness and stiffness of the legs coming on very gradually and of increased reflexes, with marked ankle clonus, together with Babinski's sign, show us that the bearing rein from

the brain, i.e. the upper motor neuron, has been cut off, and thus the control has disappeared from the cerebrum. As time goes on, the spastic condition of the legs leads to rigidity and to the typical spastic gait already described. The tone of the muscle is so well sustained that when there is the slightest relaxation the softest touch may set up a spasm again. The patient has full control of his bladder and bowel and has no impairment of sensation. The muscles do not waste until a terminal and complete paralysis sets in, but many patients can move about after a fashion and manage to look after themselves for many years despite their disabilities. The cause is obscure, but may be due to some infection, since a chill or influenza has been known to set up an attack. The treatment is mainly palliative. Tonics help to keep up the strength but strychnine is contra-indicated because it is apt to set up a spasm of the muscles. Massage and baths help the patients greatly. The latter should be kept free from all excitement.

Disseminated Sclerosis.—As implied by the name, disseminated or multiple sclerosis is a disease in which there are various scattered areas of degeneration, each of minute degree, but so widely distributed in brain and cord that they give rise to an interesting and variable set of symptoms. Various minor illnesses including worry may start the trouble, but no definite cause is known, although there has been a good deal of controversy over the question of a whorled organism which was claimed to have been seen by one school of research workers. One of the chief symptoms is usually nystagmus, which is demonstrated by asking the patient to move his eyes in various given directions. There is a distinct oscillation after the voluntary movement stops. Partial blindness is common. Another well-known sign is a form of muscular tremor which is visible only when the patient attempts to do something. For example, if he tries to drink a cup of tea, the cup wobbles about nearly out of control and is almost flung out of the patient's hand. This is called intention tremor. Thirdly, there is a peculiar staccato speech, which is accentuated because the patient is apt to drawl his words and sometimes to slur the ends of them. The other signs are very similar to those of spastic paraplegia. In addition to the spastic gait, however, there is also a certain amount of incoordination and the patient has great difficulty in controlling his movements. As time goes on, the patient develops a mentality that is very much like that of the dotage, although he may be a young adult. Ultimately complete insanity may supervene and in addition the patient is troubled with all the ills of advanced paralysis. Nurses may have to deal with all stages of disseminated sclerosis; it is an interesting study, and until the patients become moribund—usually after 4 to 6 years—they are

generally pleasant to deal with. The great essential is a quiet life for them, with plenty of rest and freedom from all excitement. Many remedies have been tried, including protein shock, arsenic, potassium iodide, liver extract, massage and electrical treatment, but there is no established specific cure.

Progressive Muscular Atrophy.—This is a very interesting condition, but somewhat rare. It affects the lower motor neuron and therefore we look for disease of the anterior horn cells. The muscles waste and become almost powerless; reflexes are lost. The signs are typical. It is noticed that gradually there occurs wasting of the muscles of the hand and soon this is followed by progressive atrophy of the forearm and shoulder. The hand is contracted into the condition of *main en griffe* i.e. the 1st phalanges are hyperextended whereas the remaining parts of the fingers are tightly flexed. In the course of a few years, there may be a spread to the muscles of the back and to the diaphragm. Ultimately the legs are affected but on occasion they may be the primary site of the wasting. There is always a fine trembling or twitching of the muscle fibres. The termination may be the result of paralysis due to involvement of one of the medullary centres, or to inflammation of the lungs. Since there is no cure for the disease, we must be content with keeping up the nutrition of the muscles as much as possible. Rest is of fundamental value, and the effect of strychnine, given hypodermically, is to maintain the tone of the muscle as much as possible. Massage and electrical treatment are also of temporary good effect.

Diseases of the Nerves

The diseases which affect the nerves are not numerous—in fact only 3 require to be studied now. These are neuritis, disease of an individual nerve and injury to an individual nerve. The first is often associated with other diseases and is therefore a secondary disease; the second and third very rarely occur by themselves, being usually part of some greater disease or injury affecting a region. On the whole, therefore, diseases of the nerves are in the majority of cases symptomatic of something more widespread or constitutional.

Neuritis.—In this condition the nerve or its sheath, especially the latter, is inflamed. The causes are excessive cold, injury, pressure applied for a considerable period and spread of inflammatory processes from the neighbouring tissues. If the patient has diabetes mellitus there is a great possibility that neuritis will develop, but gout, syphilis, arsenic poisoning and lead poisoning are also factors which influence the case. The signs of neuritis depend upon the particular nerve affected. First

there is abnormal sensation of the area of supply, which may be demonstrated by "pins and needles," burning heat, pain or tenderness to touch. The motor branches become defective and cause partial paralysis, wasting and irritability; a smooth, glossy type of skin results, sometimes with erosions, which show that the trophic function has been interfered with. The treatment depends upon the cause. Locally some form of counter-irritation is advisable.

Multiple or Peripheral Neuritis.—This is perhaps the commonest form of neuritis; it gets its name from the fact that many different groups of nerves are affected, chiefly at their peripheral terminations. The cause is a general poisoning by some chronic irritant, usually alcohol. Peripheral neuritis is often found in the chronic toper. But in addition it may be found as the result of lead or arsenic poisoning, of bacterial toxins (chiefly those of diphtheria, influenza and malaria), or constitutional weakness (e.g. in gout and diabetes mellitus) and of beri-beri. Very often the discovery of multiple neuritis leads to the investigation of the patient's drink bill; it is found in professional men and women who consume overdoses of alcohol for its soothing effect; it occurs in plethoric men of gross calibre who boast of feats of alcoholic consumption.

Symptoms.—The symptoms vary a good deal. Generally the start is regarded lightly; it may amount to a burning pain in both feet or twitching of the hands. Now and then there is fever to begin with. When the disease is fairly well established the complaint is one of numbness or tingling, or both, in any or all of the extremities. The fingers and feet "feel dead." Ultimately attacks of cramp may cause paralysis of groups of muscles, and the patient cannot walk. The wrists hang down in useless fashion—the typical "wrist drop." Even the voice may be thin and weak. The muscles quickly degenerate and they are so tender that the nursing of such patients is very difficult. In very advanced cases pain sensation may be entirely lost. A condition of mental derangement, in which there are delusions with loss of memory, may be a serious complication. This is known as Korsakow's syndrome. One very interesting sign is typical of multiple neuritis. There is ataxia of a certain type, but the patient prances like a horse because he has to raise his knees high to keep his dropped feet from the ground.

Treatment.—The removal of the source of poison usually removes the neuritis. This sounds very simple but experience proves that with alcoholic patients it is very difficult because they believe that the taking of "a little alcohol," as they term it, is a fine soothing remedy for the pain and distress, and so a vicious circle is set up. Rest in bed, with salines, simple diet and massage, is good. Foods and preparations containing vitamin B

are of value. Hop stupes or other forms of local heat applied to the limbs may be useful. The nurse must keep a firm grip of the case and her discipline of the patient must be firm without being harsh. On no account should alcohol be given.

Disease of or Injury to an Individual Nerve.—These two groups may be taken together. Injury is usually more obvious than disease and therefore when mild affections of single nerves occur, it means that a very careful watch must be kept over the patient for some time until the diagnosis is established. The following summary includes in order certain of the commoner affections of the cranial and spinal nerves.

Nerves of the Senses.—Abnormality of the olfactory nerve results in perversions of smell; defect of the optic nerve causes dimness of vision, perverted vision or blindness; loss of taste may be the result of disease or injury of the trigeminal nerve, facial nerve or glossopharyngeal nerve; interference with the normal sense of hearing may result when the auditory nerve is affected.

Certain defects of the III, IV and VI nerves of the head may cause squinting and other difficulties with the eyes. Nystagmus, an oscillating condition of the eyeballs, occurs frequently. Loss of sensation in the face, mouth or adjacent parts may be the first evidences of disease of the trigeminal or facial nerves; later the muscles atrophy Bell's paralysis of the VII facial distribution is a well-known sign. The affected side of the face is flat and devoid of expression; the eye is wide open and tears stream down the cheek. There is difficulty in talking, eating, whistling and so on, and the patient cannot show his emotion by any of the usual delicate muscular movements. Paralysis of the vagus nerve leads to paralysis of the soft palate or larynx and even to interference with the action of the heart, respiration and stomach. A very common condition is neuritis of the accessory nerve, causing pain and burning sensation of the shoulder and limiting the movements of the head. When the hypoglossal nerve is affected there is difficulty in moving the tongue and talking is indistinct.

In the spinal nerves, the phrenic nerve may be so affected on both sides that complete paralysis of the diaphragm results. This is a grave condition and is treated on modern lines by nursing the patient in a modern respiration cabinet ("iron lung"). The nerves of the brachial plexus, if injured at birth, cause Erb's paralysis, characterized by wasting and weakness of the upper part of the arm and of the shoulder. For all practical purposes the whole arm is useless, since the arm cannot be abducted, and flexion of the forearm is lost. When the brachial plexus is seriously injured the entire limb may hang listlessly by the side; operation has been tried, but with variable result. The radial nerve commonly shows effects of irritation when crutches have been used over a period. Even when a person falls asleep with

the arm over the back of a chair, the pressure may be sufficient to cause the typical wrist drop sometimes referred to as "Saturday night palsy." When the sciatic nerve is affected by neuritis, as so frequently happens, the condition of sciatica is demonstrated, but the symptoms may be evidence of a tumour or other disease of the interior of the pelvis or displacement of an intervertebral disk. It is common to find sciatica in those of rheumatic disposition who have been exposed to cold and wet. Pain, shooting down the back of the leg even to the sole of the foot, is the typical symptom. A sudden jerk, even the action of rising from a chair, may be accompanied by acute pain and there is also tenderness at certain spots all down the back of the leg and thigh. Generally the patient feels a severe twinge when the leg is extended at the knee and the whole limb flexed on the abdomen. Usually in walking, the patient proceeds on tiptoe, with the knee bent in order to keep the nerve quiet; the whole attitude is one of apprehension. In the treatment of sciatica the nurse should remember that absolute rest is essential; in fact a splint is often applied. The treatment of rheumatism must be fully instituted. All kinds of counter-irritants may be tried—blistering, cautery, painting, fomentations. In some cases stretching the nerve by operation is successful. Electrical treatment by infra-red rays, by diathermy or by artificial sunlight may be useful and massage should also be included (see Section VIII, Chapter 8).

CHAPTER 8

THE NERVOUS SYSTEM: FUNCTIONAL DISEASES

NEURALGIA. MIGRAINE. TETANY. CONVULSIONS OF CHILDREN. EPILEPSY. CHOREA. HYSTERIA. NEURASTHENIA.

So far as our present knowledge goes the diseases described below are present without any gross and demonstrable morbid change in the tissues affected. They are therefore known as functional diseases, probably for want of a better term; it may be that some method will be devised which will show a very fine alteration of the brain or nerves, but at present our microscopical range is limited and we are forced to regard the undermentioned diseases as the result of perversion of nerve power.

Neuralgia.—When for some unexplained reason a nerve transmits extraordinary sensations of pain, we term the condition neuralgia. The commonest form of neuralgia in youth is toothache, which is brought into consciousness by the pain nerve fibres telegraphing the danger signals to the brain. Apart from actual erosion of tissue, however, the pain stimulus may be difficult to define. Neuralgia is often found in delicate females—those who have never been allowed to stand up to any of the hardening elements of the weather and who are easily affected by cold, wet and other uncomfortable conditions. But neuralgia may also afflict those who are constitutionally debilitated after long illness or by long-continued strain of mental work. There is clearly a " neuralgic " type of person; such people are often depressed by the small things of life and seem to worry incessantly over trifles. Neuralgia may come to them in place of a greater and more cumulative nervous calamity and thus may be a blessing in disguise, in which case it is a symptom which demands prompt and efficient treatment.

Symptoms.—First and foremost there is pain of a peculiarly irritating and distracting nature. It is spasmodic, but keeps the sufferer on tenterhooks because it is apt to flare up on the slightest stimulus. Neuralgia of the trigeminal nerve, which supplies most of the surface of the cheeks, forehead, mouth and eyelids, is most familiar to us. It is called by the French ***tic douloureux.***

A severe attack of this type may result in motor as well as sensory disorganization. The muscle fibres become irritable and twitching of the face is common, while the tissues, especially those of the eyelids, become swollen. At the points at which the various branches of the nerve emerge from the skull there is marked tenderness. The advanced stages of neuralgia are serious, since the patient loses to a certain extent his mental control and may become desperate owing to the constant pain. Suicidal tendencies may develop unless the acute condition is relieved.

Treatment.—Vigorous local treatment is called for, no matter whether the neuralgia affects the back of the head, the chest or the sciatic region. All bad teeth must be examined by a dentist and if there is a disease focus such as a septic tonsil, it must be eliminated. A mixture of equal parts of camphor and chloral hydrate, which is a clear paint, may be applied at intervals and it is very soothing. It is an established custom to inject the nerve with alcohol or other anodyne at the points at which it emerges from the skull. All kinds of electrical treatment, including radiant heat, ultra-violet light, infra-red rays and diathermy, have been tried with variable success. A hot pack or hot fomentation may bring relief. In many cases the drug, gelsemium, has been found to succeed, although quinine, salicylates, antipyrin and caffeine in powder form are much in vogue. In extreme cases excision of the nerve or of its associated ganglion may be attempted. All mental irritation should be analysed and counteracted.

Migraine.—That there is a strong alliance between migraine and the asthma factors has been established during recent years, and a clearer understanding is now possible on this rather difficult complaint. The chief symptoms are attacks of "sick headache," of most vigorous type, one half of the face being affected with very severe pain, hence the alternative name, hemicrania. The individual is generally attacked first very early in adolescence and his life is made a burden by the recurrences, which have apparently some association with faulty diet or digestion, with worry, overwork, sleeplessness or even with epilepsy. The attacks usually begin in the morning but develop in intensity as the day goes on. In addition to the intense pain which spreads downwards from the left or right eyebrow to the lower jaw there are visual disturbances and attacks of dizziness. Ultimately the patient obtains relief by an attack of vomiting. Various local and general sedatives may be given for this condition but one of the best methods of dealing with the complaint is to watch for the early signs and to institute a 24-hour period of starvation, during which the patient drinks as much water as he can. This rarely fails especially if calomel and saline treatment

is used in conjunction. The patient should be allowed to sit alone or to go to bed in a quiet room if he wants to do so, but there is no harm in taking a walk in the fresh air, as one of the worst elements in the treatment is sympathy and the encouragement of harmful self-pity.

Tetany.—Tetany is a symptom not a disease. It is an interesting condition in which there is tonic spasm of the muscles, most obviously those of the hands and feet.

Causes.—The removal of parathyroid glands or interference with their blood supply results in a lowering of the calcium content of the blood to a point below the normal (hypocalcaemia); these small bodies are easily removed or damaged during operation on the thyroid gland. Tetany may also occur after the removal of a parathyroid tumour. Symptoms of tetany are associated with rickets. The absorption of calcium is defective owing to the deficiency of vitamin D. In addition to softening of the bones there is also hypocalcaemia. A similar condition occurs in the adult form of the disease, osteomalacia. Other causes of tetany include: 1. vomiting over a long period; 2. hypernoea, i.e. very deep breathing which occurs in some nervous diseases; 3. the taking of excessive quantities of alkalis, e.g. sodium bicarbonate; 4. severe nephritis.

Symptoms.—The spasm begins in the hands, then attacks the feet and in bad cases may affect the whole of the body. The hand is held in a cone-shaped attitude which is typical, the thumb pressing on the closely adducted fingers. There is also flexion of the wrist and elbow. This condition may persist for a few minutes and then pass off or it may last for a few days, but it usually reacts to treatment. Even if there be a momentary relaxation the slightest touch of a muscle may start the tonic spasm again. When a slight constriction is placed round a limb, spasm of the muscle will occur (Trousseau's sign). When a light tap is made over the facial nerve, contraction of the facial muscle on that side will occur (Chvostek's sign). This condition must be distinguished from tetanus, in which the hand is usually not involved, but the lower jaw is tight and its muscles contracted from the start. Pain is a feature of tetanus. (See p. 397.)

Treatment.—Even under drastic treatment the symptoms due to removal of one of the parathyroids tend to persist for some weeks or months. Usually the remaining parathyroids hypertrophy and thus compensate for the deficiency. In severe cases abdominal spasms and irreversible eye changes (cataract) may occur. During actual attacks of tetany parathormone (parathyroid extract) should be injected. A high calcium diet and calcium lactate by mouth give more permanent relief.

Infantile tetany is cured when sufficient vitamin D is added to the diet. Fresh farm food, milk, butter and eggs and regular

doses of halibut- or cod-liver oil will promote absorption of calcium, especially if the child should live in the sunshine.

Convulsions of Children.—Infantile convulsions are common in private practice, especially in the industrial districts, where hygienic conditions may not be as good as they might be. They usually occur before the child is 2 years old, and they may be early evidences of epilepsy, especially if they persist despite treatment after the age of 3. Generally, however, a convulsion is simply the external evidence of some dietetic fault and is speedily relieved with appropriate treatment. The nurse should know a good deal about convulsions, especially if she contemplates the taking up of welfare work.

Causes.—Any debilitating factor, such as rickets, marasmus, poor digestion, improper feeding, threadworms, infectious fevers or congenital syphilis, may be at the root of a series of convulsions, but irritating factors such as phimosis, teething and earache may also have an influence in the condition. Above all it must not be forgotten that there is a strong hereditary factor in convulsions; the parents who are excitable, nervous and rather unstable in their mental composure are more likely to have convulsive children than are others.

Symptoms.—The convulsions may occur at intervals or one after another. They are characterized by preliminary signs which are evidence of such conditions as are mentioned above. But particularly there may be constipation, frettiness, green stools and perhaps a history of the child having had a small piece of kipper or a teaspoonful of stout from the table. To begin with there is stiffening of the body and the child becomes pale. The eyes then turn up, a short cry escapes and clonic movements of arms or legs, or of both, begin, the child frothing at the mouth. Absolute unconsciousness occurs during which it may be noted that the child squints. The after-effects are those of mental dullness, with fatigue and sweating.

Treatment.—A weak mustard bath, tepid and about 6 inches deep, should be prepared. The child is placed in this bath, and cold (or ice) compresses are now applied constantly to the patient's head. He soon comes round, and he should then be quickly dried and put to bed. In very severe cases chloroform may have to be administered and a course of bromides instituted after the fits have stopped, but usually it is quite sufficient to give the child a grey powder, followed by saline laxative or castor oil, and a day's starvation can do no harm. Then should follow a revision of the whole of the domestic routine and a few words of wisdom should be addressed to both parents on the simple art of child rearing. The nurse should check over the causative factors and make arrangements to have any defects put right. Later on the child may benefit by cod-liver oil and malt and a change of air.

Epilepsy.—The state of epilepsy is one which has outstanding characteristics some of which are more in evidence in one case than in another, and therefore the most modern writers speak of the disease as covering a group of nervous disturbances of somewhat obscure origin, and referred to as the epilepsies. There may be some connexion with the asthmatic state, since certain diets are known to influence the condition, but so far research has not been able to explain the basic cerebral factor responsible for the complaint. There are, however, definite changes in the cortical cells of the brain, which can be demonstrated by means of the electroencephalogram.

Causes.—Apart from the common convulsions of childhood, epilepsy occurs in children very early and it may not be proved that "convulsions" are in reality true epileptic fits until the child is well past the age of infantile convulsions. As a general rule all epileptic subjects have completely demonstrated their affliction before they reach the age of 20. In adults true epilepsy must be distinguished from the similar type of fit which is to be expected in cerebral syphilis, alcoholic poisoning, nephritis and hysteria. Jacksonian epilepsy is a state of irritability of the brain resulting in occasional epileptoid fits and is due to injury, by accident or otherwise, to the cortex of the brain. Undoubtedly true epilepsy is a degenerative sign and it nearly always occurs in the offspring of nervous, alcoholic or mentally afflicted parents. The attacks may be intensified or stimulated by shocks, injuries, illnesses, toothache, worm infestation and sundry other factors and are always associated with some extra mental strain which may not be very obvious.

Symptoms.—The main symptoms are the classical "falling sickness," fits and peculiar after-effects. It is convenient to divide the epileptic attacks into 2 groups, the more severe being known as *grand mal* and the less severe as *petit mal.*

Grand Mal.—In *grand mal* convulsions are a feature. The typical epileptic fit is recognized in 3 stages as follows. To begin with there is the peculiar aura or warning, which may take various forms. There may be a transient attack of dizziness, but usually there is a definite warning of the approaching fit and this aura is sensory in character, giving rise to sensation of sight, or of smell or of hearing. Many people do not experience the aura. The next stage is that of the fit. First of all there is a short cry, as if the patient had suddenly become possessed of a great fear. Almost at once he falls down completely unconscious no matter whether he be in the street, in a theatre or at his own fireside. The body then stiffens into a state of tonus, the eyes being turned in the direction in which the tonic contraction is strongest. The hands are tightly clenched, the elbows completely flexed and the lower limbs stiffly extended. The

patient turns very pale for a moment, then the face becomes very blue owing to spasm of the respiratory muscles. The pupils are wide and fixed. The period during which the patient is held in this great grip is usually a little over half a minute. It immediately gives place to another in which clonus is the feature, all the muscles going through a coarse rhythmic convulsion and the muscles of the face twisting in a most alarming fashion. Owing to the fact that the tongue is generally protruded, it is bitten by the teeth, and blood-stained saliva foams out of the mouth. The face becomes purple, congested and swollen and the eyes seem to burst out of their sockets. After a period of 2 to 3 minutes the paient quietens down and he may regain consciousness which is somewhat dazed, but commonly he passes from the convulsive stage into a state of coma, which is followed by deep sleep. This sleep may last for a few hours, after which the patient gets up, but he is more or less weary, tired and mentally dull. Incontinence of urine or of faeces is common. When there is a succession of fits, the condition extending over several hours, it is known as the *status epilepticus*, a very serious phase.

Petit Mal.—Although convulsions do not occur, *petit mal* may have all the other mental signs of epilepsy —the aura, the unconsciousness, the dullness afterwards. The whole group of the epilepsies is difficult to sort out, and as time goes on we are discovering more and more evidence of the existence of types of *petit mal* which may occur unknown to anybody else but the patient.

After-effects.—Undoubtedly the after-effects of epilepsy are much more serious than is fully understood. Indeed, it is gradually being realized that much of the most desperate crime may be committed when a person is under the influence of post-epileptic mania and this should always be kept in mind when the patient is casually dealt with in the street. Apart from violent maniaccl outbursts, there is the common condition of automatism. In this state a patient may do many things about which he has not a single recollection afterwards; he may make a clean sweep of the Ten Commandments and afterwards be quite unaware of his transgressions. This offers a tremendous subject for discussion between legal and medical experts in criminology, and while it is impossible to put the blame on epilepsy for all misdemeanours there is a probability that in the future the epileptic settlement, and not the prison cell, will be the method of cure of certain forms of crime.

Treatment.—The first-aid treatment has been outlined in Vol. I, p. 350. Let it be repeated that the limbs during the convulsive stage should be controlled and not forced, and the patient should be prevented from doing damage both to himself and his

neighbours. The tendency to turn over on the face should be corrected. Unfortunately many deaths occur from suffocation during the night, since the patient has a seizure in bed and turns over on his face to be asphyxiated by the pillow.

The preventive methods of treatment are legion. Probably the greatest advance in treatment has been the establishment of epileptic colonies in which patients are voluntarily segregated, specially treated, watched and guided before and after fits and generally allowed to develop an appropriate life of usefulness according to their condition. Bromides were formerly in great favour as a medicine, but have been superseded by "Luminal" (phenobarbitone) the dose of which is adjusted according to the requirements of each case. Recently, the drug "Epanutin" has been used, and is said to be efficient in controlling the fits. Any slight defects of health—carious teeth, tonsillitis, irregular menstruation, sluggish liver, constipation—should be corrected. If bromides are being taken in considerable amount the occurrence of bromide acne must be looked for; it is very depressing to the patient, and a distinct disfigurement. Epileptics require constant supervision; they must never be allowed to bathe alone, and they should be watched when the aura occurs as they may be saved a dangerous fall. Indeed the fit can sometimes be aborted if the patient remembers to grasp one arm tightly in the opposite hand.

Chorea.—Better known as St. Vitus's dance. chorea is very common among children, but its incidence is diminishing. It is associated with rheumatism and heart disease and its typical jerky movements affecting the muscles make it easy of recognition.

The causes are probably a group of organisms of rheumatic type, but nothing definite has been proved so far. The spasms of the muscles might reasonably be the result of a toxaemia. Females are far more susceptible than males and it would seem that this is due to the more sensitive female organism becoming more easily upset by the circulating poisons. Chorea commonly follows rheumatic affections and comes on in convalescence from rheumatic fever or endocarditis as the result of sudden shocks, frights or ordinary excitements. It is chiefly found in girls between 4 and 12 years of age. Undoubtedly heredity plays a big part, the children of highly strung parents being more susceptible than others.

Symptoms and Signs.—The condition may be summed up by calling it one of excessive and uncontrollable fidgets. The arms and legs flap about meaninglessly and the face is twisted up into all sorts of contortions, some of them quite facetious in type. The movements become worse when a specific act, e.g. picking up a toy or a book, is attempted. In the condition of hemi-

chorea, only one side of the body is affected and there may be temporary paralysis, but the child is always quiet during deep sleep. The great strain on the heart leads to irregularity and general fatigue. The child also becomes very emotional and is easily upset by joy or sorrow, so that there is a strong hysterical element. Cases may drag on for months, with spurts of betterment and days on which relapses retard progress.

Treatment.—This consists in complete rest free from physical and mental excitement. If cardiac complications arise this should be continued for some weeks or even months. All exciting factors must be removed. Patients do well when they are isolated as for infectious diseases. The bed should be well padded with pillows so that although full scope is given for the movements there is no danger of injury. General tonics and the usual routine nursing are all desirable and great patience must be shown. Sedatives may have to be given in severe cases, aspirin being the most helpful, but generally the effect of careful nursing, of good nourishing food and of tonics such as cod-liver oil and malt is to make the child free of jerks in 3 or 4 months; after this massage, easy gymnastics and carefully graduated exercises should be instituted, together with an open-air life. In very bad cases, spoon feeding may be necessary, and a water bed is a great help. Drinks should be given through an infant's feeding bottle in order to prevent the patient from biting through the glass tumbler.

Hysteria.—In these modern days when the mind is often more active than the body and when the intellect is more in demand than the muscular action, it is inevitable that functional disease of the mental apparatus should occur. Normally the brain acts by the control of the will, and we speak of will power as having a grip on the reins which direct our every action. When there is a slackening of the reins or of one or two, there is lack of balance and one horse of the team pulls more than the other. In other words there is loss of the normal balance of the emotions and the motor apparatus of the body. Pure hysteria is not far removed from sheer naughtiness. It is founded on great mental complexities, and like many of the neuroses of today it requires careful and intimate psychoanalysis, a description of which does not come within the scope of this work. The patient, generally a woman, knows what she should do and is in full possession of her faculties, yet wilfully allows her inhibitory powers to relax, with the result that her conduct is anti-social and is characterized by exaggerated emotions and actions, completely out of scale with the picture of normal good mental or physical health.

Causes.—Hysteria is not a simple disease to investigate and it is a very difficult disease to describe, because it is so comprehensive and so utterly negative to physical examination. The origin

of hysteria is usually some crisis of young adult life when, presumably, there is the greatest strain on the intellectual functions. The crisis may be mental or physical, the hysteria developing as a kind of aftermath, suggested by the experiences through which the patient has passed. Heredity plays a certain part but only in a general way, the instability of the will being traceable to numerous possible factors of mental abnormality in parents or other relatives. Prolonged strain seems to weaken the will and lead to the demonstration of false symptoms; this type of hysteria was common in the World Wars. In effect the index of the neuron is "below par." Any sudden shock or extreme stimulations, e.g. laughter, may cause a "fit of hysterics," but this has to be distinguished from an established hysterical state in which the patient creates around her a certain atmosphere, imitative of disease, but failing utterly when taken to proof. In both conditions, a neurotic environment with fussy and doubting relatives and the general aura of fear and apprehension are commonly found. Various authorities have their own theories as to the actual causation, but as a general rule hysteria may be regarded as a result of fixed ideas; or of suggestion; or of obscure injury to the mental apparatus, the expression of which is perverted.

Symptoms.—A volume could be written on the thousands of symptoms demonstrated by hysterical people, and taking origin in the senses, the motor system, the internal organs and the mind itself. Generally speaking, however, it is possible to diagnose hysteria from its exaggerated and sudden symptoms which may come on with the very slightest stimulation from the fact that when organic disease is imitated there are gross defects in the picture and from the lack of signs, which are inevitable in true organic disease. The condition described by the patient is not wilfully false, but the mind determines to portray a certain picture because the afferent influences continue to stimulate it to do so, and thus there is apparent deception. One of the biggest problems of hysteria is that the patient frequently imitates disease as has been mentioned above, and this accounts for numerous groups of symptoms which puzzle the medical man at first but amuse him afterwards, since many cannot be mutually reconciled. The situation is made more ludicrous by the gradual addition by the patient of other odd symptoms, the number and intensity of which usually depend upon the sympathy and impressionability of those around. In all these cases the doctor, with his routine examination, can expose the fallacies. Thus it is common for hysterical people to complain of anaesthesia, but they do not know how the nerves are distributed therefore they choose the "glove area" or the "stocking area," and imagine that they have no feeling, or some kind of perverted feeling, at

these parts. The test for this is to stick a sharp needle into the so-called "insensitive" region when the patient is asleep; this rarely fails to create a vigorous response. In addition to the above, there may be various other feelings of pins and needles, or heat or cold, of peculiar shapes and weights of things and of excessive tenderness in certain spots, the touching of which leads to a hysterical fit. The sensation of choking (*globus hystericus* or "lump in the throat") is a purely hysterical sign, as is also the feeling that there is an abdominal tumour or a state of pregnancy. All kinds of sight defects may be complained of and speech may be stuttering. A hysterical patient may simulate deafness until roused from sleep by the breakfast bell. All kinds of paralyses, tremors, gaits, convulsions—indeed a complete parody of all the organic nervous diseases—may be demonstrated, especially if the patient has had an opportunity of watching the evidences of disease. Palpitation, loud and uncontrolled coughing, ceaseless vomiting, bladder irritability, are all signs of the hysterical nature also. Nearly all the "wonderful cases" and the "marvellous cures" of the daily newspapers are due to hysteria in the patient, and to faith healing, individual magnetism or the personality of the doctor. The hysterical person is selfish and egotistical, melodramatic and plausible. She flourishes on the sympathy of her relatives, and may create such a strong element of servility round her that she lives with a retinue of a queen and luxuriates in the unnecessary comforts of the invalid state. When she cannot get what she wants by weeping, by imperious demand or by pitiful appeal, she may have the typical hysterical fit, which is imitative of epilepsy, but is different in that the patient rarely injures herself, and generally chooses a soft floor or sofa on which to fall. There is no loss of consciousness and no real convulsions. The fit may continue for a quarter of an hour, depending upon the whim of the patient, but it need not cause the slightest alarm, being merely an attempt to frighten a credulous audience. When all fails to obtain the sympathy which is so eagerly sought, the hysteric may take steps to produce a rash on the skin by rubbing on chemicals or to cause an ulcer by pressing a hot sixpence into the flesh or to colour the urine with red ink. Even the thermometer may be overheated but this is generally so excessively done that the fraud is discovered.

Treatment.—Despite what has been said about the falsity of the symptoms we must never forget that hysteria is an accepted disease, and that if the sufferer were stable in the mind such events would not be allowed to occur. Long, careful and painstaking observations must be conducted for months, during which the doctor slowly unearths the deeply rooted fears or worries or anxieties which have led to the demonstration by the patient that she has taken refuge in illness. The nurse who is to succeed with a

hysterical patient must always show the strongest side of her character and having gained the complete confidence of her patient, be ready to withstand the inevitable attacks which are made from time to time on her purpose. All nurses should remember that until a hysterical patient is "round the corner," and able to complete the cure herself, she is waiting like a cat to spring on the first mouse of weakness shown by those who are in attendance. For this reason it is always unwise to treat the hysterical patient in her own home; she must be right out of the environment of sympathetic and fussing relatives and there is no disease which requires more courage and more noble determination towards both the patient and relatives than hysteria. Various kinds of treatment of the mind process may be advised—hypnotism, suggestion and the like. There is a rule for every individual. But the nurse must remember that her own personal feeling must be completely submerged and she must be prepared to conduct a vigorous campaign of truth against error, so that although she may get nothing but scorn and criticism and unpopularity for her trouble, she can subdue the domination of false values and lead the patient back to normal understanding and a sense of accurate relationship with her surroundings and the world outside. Drugs are notoriously useless. Fresh air, exercise, massage, gymnastics, baths, occupational therapy and constant urging of the patient to go on from strength to strength should be the watchword. When the hysterical patient abandons herself so completely to a fit, she can be quickly stimulated to better ideation by the emptying of a handy jug of water over the head or by other simple and efficacious methods of bringing her to her senses.

Neurasthenia.—Neurasthenia is a common sequel to debilitating fevers such as influenza, but it also occurs after long spells of work—especially mental work—and it is accompanied by a depression which has a negative influence on the whole body. Now and then, after a railway accident, although the original shock is overcome the depression and nervousness are continued until the compensation is paid, then follows rapid recovery. Neurasthenia is a disease which indicates a condition of weakness and exhaustion of the nerve cells and fibres. Nowadays it is associated with brain fag, anxiety, neurosis and the like, and all show evidences of lack of concentration, sluggish movements, fear of death or grievous disease, poor physique and capricious temper, chiefly of irritable or negative type. The neurasthenic is completely self-centred; he imagines all sorts of things about himself and he is ready to pounce on any new placebo or quack remedy suggested to him. He cannot settle to anything for long, and there is no doubt that he radiates gloom wherever he goes. The common signs of neurasthenia are headache, with a feeling

of tightness or " wool " in the head, noises in the ears, weak eye-sight, palpitation, dyspepsia and general dismal outlook on every-thing in life. The treatment must be prolonged if good results are to be obtained. A man who has become completely under the influence of neurasthenia must be taken from his friends and relatives and put to bed until he is well rested and able to be built up in nerve power again. After he is put through the Weir Mitchell regime of isolation, cold baths, massage and abundant food, he should be further stimulated by recreations, hobbies, games and useful occupation of a type suitable to him Tonics and stimulants are helpful in a subsidiary way.

CHAPTER 9

DISORDERS OF METABOLISM AND DEFICIENCY DISEASES

DEFICIENCY DISEASES. RICKETS. INFANTILE SCURVY. ADULT SCURVY. BERI-BERI AND PELLAGRA. METABOLIC DISEASES. ALKALOSIS AND ACIDOSIS. OBESITY. GOUT. DIABETES MELLITUS. CAUSES. SYMPTOMS AND SIGNS. TREATMENT. DIABETIC COMA. HYPOGLYCAEMIA.

In this chapter the various diseases which arise on account of some defect or disorder of the metabolism are discussed, diabetes mellitus, although it is in fact an endocrine disease, being included because of its widespread effect on the mechanism of the body. The other diseases are the results of vitamin deficiency or of some inexplicable abnormality of the metabolism.

Deficiency Diseases

Rickets.—Forty years ago rickets was a common disease of the slums, and it accounted for many square heads and bent tibial bones. Nowadays it is a rarity, and owing to increased knowledge about vitamins it is likely to be completely wiped out.

Causes.—Improper feeding in infancy, bad hygienic conditions, want of sun and lack of fresh air—in fact all the essentials of the slum existence—are at the root of rickets. It attacks children between the ages of 6 months and 3 years and may be said to be caused by too much starch and too little animal fat (containing vitamins A and D). Vitamin-D deficiency is of paramount importance (see p. 180). There is little to add to what has been said about the importance of vitamins and sunlight in rickets.

Symptoms.—These are due to the deficiency of calcium and phosphorus in the bones, which become deformed. In the head, the fontanelles remain open for a long time and the head becomes square and bossed, so that it appears to overwhelm the face, giving the child rather a pathetic look of wisdom much beyond his years. Teething is late and there is early decay. There is great sweating of the head, indigestion, " pot-belly," chronic cough and general irritability. The chest shows two important signs.

The first is a grooving of the lower part of the chest running outwards from the tip of the sternum as if the thorax had tried to fold its upper part on its lower part. This is called Harrison's sulcus. The second is a beady swelling, visible and palpable along the junction of the ribs and costal cartilages and known as the "rickety rosary." There may also be a condition of pigeon chest. In addition to the bending of the bones of the leg and forearm the epiphyses are swollen at the ankle and at the wrist. The child is generally soft and flabby and does not take much interest in life. If rickets is allowed to progress it may result in permanent knock-knee, bow-legs, or flat contracted or deformed pelvis, a great handicap in females during subsequent childbirth. All these troubles can now be controlled by the efficient methods of modern treatment described below, but if they should occur here and there they require to be dealt with by special splinting and other surgical treatment.

Treatment.—Thanks to the common provision of infant welfare centres, children who show signs of improper dieting and who have bad hygienic surroundings may be provided with ample artificial food and halibut-liver or cod-liver oil and malt. Ultra-violet light, gentle massage and irradiated ergosterol may all be provided as necessary, a qualified nurse at the clinic regulating the doses under medical supervision. The same results would be obtained, of course, if the child were transferred to the country, where he could have abundance of sun and fresh air together with a scientifically accurate diet.

Infantile Scurvy.—This is known as Barlow's disease. It is due to deficiency of vitamin C and may be found from the 8th to 18th month. It is generally the result of the use of patent foods. The child develops suddenly a great tenderness all over, but especially of the lower limbs, which may give the impression that they are paralysed. The gums are soft, spongy, tender and haemorrhagic. The child usually screams with the pain. Swelling of the ends of the bones is due to bleeding under the periosteum. In some cases the bleeding may become generalized and occur from the intestines and bladder. The treatment is as already described, but the greatest care should be taken to ensure that the child is protected by cotton-wool jackets and pants of simple type; ordinary clothes are often out of the question owing to the excruciating pain. The child cannot bear even the weight of the bedclothes.

Adult Scurvy.—This is not often seen now, but it occurs occasionally when faddists imagine they are unable to digest fruit and vegetables and consistently exclude them from the diet. Sailors and explorers were at one time great sufferers from this disease, as for long months they existed on a diet devoid of

Vitamin C—not containing any fresh milk, fruit or vegetables.

Beri-Beri and Pellagra.—These are common diseases in countries in which polished rice is the staple food. The symptoms of both diseases often occur simultaneously in the same person. They are due to deficiency of the vitamin B complex—actually a group of vitamins present in the same foods. There may be lack of other vitamins in the diet, making the clinical picture somewhat complicated.

Symptoms of Beri-Beri.—These include cardiac enlargement, impairment of the circulation with consequent oedema, anorexia, nausea and vomiting, diarrhoea. Degeneration of nervous tissues gives rise to peripheral neuritis and eventually to paralysis.

Symptoms of Pellagra.—These include skin eruptions, a peculiar redness of the skin with swelling and desquamation. Changes in the mucous membranes cause soreness and ulceration of the tongue as well as gastro-intestinal symptoms with abdominal pain. There is progressive mental deterioration, the patient becoming depressed and lethargic and later confused and maniacal.

Further information regarding the above diseases is given on p. 180.

Metabolic Diseases

Alkalosis and Acidosis.—The alkaline reaction of the blood is kept constant in health, but in certain diseases this balance (the acid-base equilibrium) is upset. The blood always remains alkaline, but if it is more strongly alkaline than normal the condition is known as alkalosis (alkalaemia); if it is less alkaline than normal the condition is known as acidosis (acidaemia). Both these conditions are due either to alteration in the normal amount of carbon dioxide dissolved in the blood or to alteration in the normal amount of bicarbonates in the blood.

Alkalosis.—Conditions associated with alkalosis are hyperpnoea (deep breathing), lack of oxygen supply (e.g. in high altitudes or in cardiac failure) and overdosage of alkalis (e.g. sodium bicarbonate).

The symptoms of alkalosis include headache, irritability and vomiting. Later there may be muscular cramps and twitchings, or even convulsions.

The treatment depends upon the cause, but relief is obtained by giving oxygen by inhalation and ammonium chloride by mouth. If the symptoms are due to overdosage of alkalis these are discontinued at once.

Acidosis.—The chief conditions associated with acidosis (acidaemia) are diabetes mellitus, nephritis, starvation and the "cyclical" vomiting in children.

The symptoms of acidosis include vomiting and later coma.

The treatment of diabetic acidosis and ketosis is fully dealt with on pp. 339 and 340. When acidosis is due to causes other than diabetes mellitus, administration of glucose, fruit drinks and sodium bicarbonate usually abates the condition. In more severe cases rectal or intravenous saline glucose is given.

Obesity.—The causes of obesity are legion. There is usually a strong hereditary factor. It may be due to frank over-eating or to thyroid deficiency; on the other hand it may be the result of a general endocrine imbalance. The elderly diabetic, as mentioned previously, is nearly always obese.

Treatment.—This is mainly dietary (see p. 187). Thyroid extract is sometimes prescribed, but may not be effective; it is occasionally dangerous unless there is undoubted thyroid deficiency. In this case care must be exercised in the regulation of dosage according to individual requirements.

Gout.—In this disease, which is on the wane and which was formerly associated with excessive eating and drinking, there is too much uric acid in the blood, and a substance called biurate of sodium is deposited in the joints causing inflammation and general arthritis of a very acute and painful type. The diet is fully dealt with on p. 189.

Symptoms.—The main symptoms of acute gout are an inflamed great toe and an inflamed temper. The attack may last a week or longer, and during this time the patient may have loss of appetite, dirty tongue, offensive breath and constipation. The joint becomes very swollen and red and it seems as if it might burst like an abscess, but usually it shrinks back to normal leaving great flakes of skin to desquamate. In the acute days and nights the patient gets no peace, nor for that matter does the rest of the household. It is essential to wrap up the affected foot in thick rolls of cotton wool and to protect it against jolts or jars. Gout may become chronic, affecting toes and fingers, and there are peculiar chalky collections of "joint-stones," which sometimes ulcerate through the skin; these are known as tophi. Ankylosis is common in advanced cases. The whole disease is very like rheumatoid arthritis (described later), but the patient, although he becomes lame and restricted, is not so seriously affected in the joints. It must also be borne in mind that many old people show evidences of a gouty tendency and yet have no serious joint troubles; they show, however, many exaggerated signs of circulatory, respiratory, digestive, urinary and nervous disabilities, which are more accentuated than the changes associated with the natural senile degenerations.

Treatment.—The treatment of gout locally is as already described; if necessary some soothing liniment may be applied. The dietetics have been outlined on p 189 The internal treatment

consists in giving plenty of mercurials and salines, together with preparations of colchicum. Much success has resulted from the use of this substance, which is taken 3 times a day every other day, and which keeps the blood free of excess of uric acid; gout is thus prevented by its use.

Diabetes Mellitus

Although diabetes mellitus is the result of a degeneration of the islets of Langerhans in the pancreas and should therefore be included among the diseases of the endocrine system, it is still commonly referred to as a constitutional disease and therefore it is dealt with in this Chapter. It should be noted that diabetes mellitus does not have any connection with diabetes insipidus, which is a different type of disease altogether and which is described on p. 348.

It has been shown that the islets of Langerhans produce a hormone which is known as insulin, and that the latter is one of the chief agents which regulate the combustion of sugar in the body.

Briefly the process works normally as follows. Carbohydrate in the form of sugar (dextrins) and the end-products of proteins (amino acids) are absorbed by the small intestine, carried by the portal vein to the liver and stored there in the form of inactive glycogen; the muscles also accommodate a large supply of glycogen which can easily be turned by the liver into glucose (grape sugar or dextrose) as required. This is the whole principle of storage of sugar in the body. Although a small amount of dextrose regularly passes into the blood and is most prominent after a meal, no apparent harm is done; a typical sample of blood would show anything from 0·08 to 0·12 grammes per cent of glucose, but after a meal containing 100 grammes of dextrose, there would be considerably more sugar in the blood, although there would still be no harmful effect. The healthy pancreas can deal with much greater concentrations of sugar but at no time does it allow the blood sugar to exceed 0·2 per cent. There may be occasions on which owing to some temporary derangement the amount of glucose in the blood is above this figure, and we find the condition of hyperglycaemia to be established. The latter is relieved by the passage of sugar through the kidneys and the condition of glycosuria is found. If, however, there is a permanent hyperglycaemia, owing to actual defect of the islets of Langerhans and the consequent absence of ample insulin, we have the condition of diabetes mellitus. The point beyond which sugar leaks into the kidneys is always referred to as the renal threshold, i.e. 0·2 per cent. In severe diabetes there may be three times this amount of sugar in the blood. A definite train of

symptoms, described below, then follows. In some cases after the stoppage of carbohydrates and even in starvation, sugar may be manufactured from the proteins which have been built up into the tissues or from the nitrogenous elements of the food as the case may be; this sugar accumulates in the blood. Coincident with this state of affairs there is imperfect metabolism of both proteins and fat and especially of the latter. The result is the production of diacetic acid, acetone, and β-oxybutyric acid in excess in the blood, the condition being well known as acidosis, acetonaemia or ketosis. These have a depressant effect on both the circulatory and nervous systems and lead to diabetic coma.

With regard to glycosuria it should be emphasized that presence of sugar in the urine is not always a sign of a diabetic condition. Glycosuria is commonly found during lactation but has then no pathological significance. Concussion and other brain injuries often produce a temporary glycosuria. Some persons also have a low renal threshold, i.e. the urine contains a small amount of sugar although the blood sugar level is normal.

Causes.—There is a certain hereditary and racial disposition and Jews are said to be more susceptible than others. Infection may be associated with the onset of diabetes mellitus. In the elderly, obesity and gout appear to be predisposing factors. Injuries to and diseases of the pituitary gland produce diabetes, indeed dysfunction of this body is thought to be the primary cause of the disease.

Symptoms and Signs.—There are two types of diabetes mellitus. One affects the elderly and obese, in which the disease begins insidiously; both males and females may be affected. There are complaints of tiredness, pruritus (itching) of the vulva in women, thirst and polyuria.

Urine in Diabetes:

Pale, clear, acid.
Specific gravity high—usually 1,025 to 1,045.
Quantity per day, 10 to 15 pints.
Sugar in abundance.
In advanced cases, acetone, diacetic acid, β-oxybutyric acid present.

The complications include boils and carbuncles, neuritis, gangrene of the toes and sometimes of the whole foot, retinitis with consequent gradual loss of sight and cataract. Coma is uncommon in this type of the disease.

Secondly there is the acute type which affects young adults and children. There is great and rapid wasting, inordinate hunger and thirst, polyuria. The breath smells of "new mown hay," the result of ketosis. Sugar and acetone are found in the urine, often in large amounts. The blood sugar level is high.

Coma may develop at any time and is preceded by hyperpnoea (" air hunger ")—long, deep, sighing respirations. This is a cardinal danger signal of approaching diabetic coma. Coma is precipitated by the presence of any infection such as cold or influenza, but particularly tuberculosis to which the diabetic subject is especially prone.

Treatment.—The elderly obese type may not require to have insulin, unless the blood sugar content is very high and the glycosuria very marked. Patients often do quite well on a restricted diet, carbohydrates especially being limited. The subject is fully dealt with on pp. 186–188, to which the nurse is referred. The urine and blood must be examined at regular intervals; patients should attend a recognized diabetic clinic and should be under specialist supervision.

The young acute diabetic can seldom do without insulin and requires what is known as a " high carbohydrate " diet. The caloric value of the diet requires to attain a standard suited to his growing strength and capacity for leading a normal life. He must attend a diabetic clinic regularly and periodically must have his insulin and diet requirements reassessed and "balanced" (see p. 187). When balancing the diet, the patient should as far as possible pursue his normal activities. He must learn to give his own insulin and regard it in the same light as he does his daily toilet—as a normal procedure. In this way many diabetics are able to adjust themselves to their disability and to live a healthy life. Any source of sepsis, e.g. teeth or tonsils, must never be neglected. It is also wise to have a radiological examination of the chest at regular intervals.

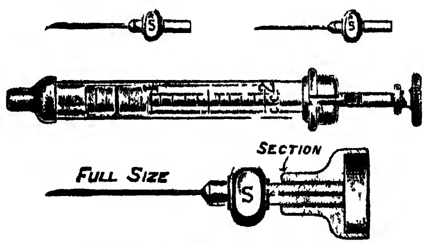


FIG. 65.—INSULIN SYRINGE.
(By courtesy of the Surgical Manufacturing Co., Ltd., London.)

Diabetic Coma.—The onset is not usually rapid. There is increasing lethargy, vomiting, headache, constipation and abdominal pain. Coma is usually always associated with infection. The thirst and polyuria become more pronounced; the patient is greatly dehydrated, the eyes sinking into their sockets; the tongue is red and dry. Consciousness is gradually lost. The strong smell of acetone in the breath is characteristic and also the long sighing respirations mentioned above.

Treatment.—The patient should lie flat, since even after successful treatment of the coma death may take place from heart

failure. He should be treated for shock with warm blankets and hot bottles. Sometimes an electric cradle is used but this has its dangers.

Specimens of urine and blood must be obtained, the blood being sent for sugar estimation to the laboratory, the urine tested for sugar and acetone. An injection of 60 units of soluble insulin is usually given as the initial dose as well as 60 grammes of glucose. When the coma is profound this can be given by the nasal route. More efficiently an intravenous glucose saline may be started at once, and this should be allowed to run in fairly quickly. It is not always easy to perform venepuncture in a collapsed and dehydrated person and if the intravenous route fails, glucose saline must be injected into the rectum or into the peritoneal cavity, from which it is absorbed with great rapidity. Glucose must never be given by the subcutaneous route, as it causes sloughing of the tissues. The lack of fluids, however, must be remedied at all costs, otherwise the patient will die of dehydration.

Estimations of the blood and sugar content are made every 2 or 3 hours while the coma lasts. On the result of these depend the subsequent dosage of insulin and glucose. On return to consciousness, copious fluids are given by mouth and the diet gradually established with adequate insulin dosage. At no time must the patient be starved, and if the solid diet is not tolerated "Benger's Food" is a good substitute.

During the state of collapse the constipation may be neglected, but when the general condition has improved sufficiently, enemata should be given. Coramine (nikethamide) may be injected if there are signs of heart failure.

Hypoglycaemia.—When insulin is injected the blood sugar content falls and when sufficient carbohydrate is not eaten or when unwonted exercise is taken, a state of insulin coma (hypoglycaemia) develops. This is quite different from diabetic (hyperglycaemic) coma. Insulin coma is usually sudden, with dizziness, sweating and apprehension as warning signs; there may be muscular twitchings or convulsions. The patient may behave as if he were intoxicated and then collapse in an unconscious state.

Treatment.—These attacks must be prevented as far as possible. All diabetic subjects taking insulin should be provided with a few lumps of sugar or barley sugar which they can eat if symptoms of hypoglycaemia should develop. Careful explanation of this must be made to every patient before he leaves hospital. An identity card should also be carried, stating that the person is a diabetic and instructions given as to where he should be taken in case of emergency. This often saves a good deal of trouble and anxiety. When insulin is taken before the evening meal, ade-

quate carbohydrate intake is necessary to prevent coma from developing during sleep.

If coma is well established, 5 minims of adrenalin (1–1,000) should be given to utilize liver storage of glycogen. This is followed by a nasal feed of glucose (1 tablespoonful in water). Consciousness will usually return quickly. It is seldom if ever necessary to give glucose intravenously. Insulin coma is not often fatal but on no account must an unconscious diabetic be given insulin before the cause of his unconsciousness is ascertained. If there is no acetone in the urine he is very unlikely to be suffering from diabetic coma.

Spontaneous Hypoglycaemia.—This may occur as the result of the presence of a tumour in the islets of Langerhans producing an excessive amount of insulin. The diagnosis is often difficult and the patient may be treated for cardiac disease, epilepsy or mental derangement before the true nature of the disease is realized. Operative treatment by removal of the tumour cures the condition.

CHAPTER 10

DISEASES OF THE ENDOCRINE SYSTEM

DISEASES OF THE THYROID GLAND. GOITRE. HYPERTHYROIDISM. MYXOEDEMA. CRETINISM. DISEASES OF THE ADRENAL GLANDS. ADDISON'S DISEASE. DISEASES OF THE PITUITARY BODY. DISEASES OF THE ANTERIOR LOBE. DISEASES OF THE POSTERIOR LOBE. DISEASES OF THE THYMUS GLAND. DISEASES OF THE PARATHYROID GLANDS.

As time goes on and more and more is discovered as a result of research in the activities of the ductless glands, so is there a corresponding advance in knowledge of the diseases associated with endocrine defect or deficiency. Particularly is this evident in regard to the gonads (already referred to and further discussed later on in this work) but there are many new facts about diseases associated with the thyroid, adrenal, pituitary, thymus, parathyroid and other glands, which are dealt with below.

Diseases of the Thyroid Gland

The diseases of the thyroid gland may be grouped into two main categories depending upon the deficiency or excess of the extract manufactured by its cells. The whole science of endocrinology is at present undergoing rapid changes and new discoveries are being made every day. It is clear that the thyroid gland, like the pituitary gland and the adrenal gland, does not have an independent action. It is in the first place under a certain control exercised by the sympathetic nervous system; secondly it is affected by the secretions of other ductless glands (e.g. the pancreas and adrenal gland); thirdly it frequently takes only a part in the production of a condition characterized by defect of more than one ductless gland. We already know that often one hormone is the antagonist of another. The pituitary body is probably the controlling factor; it has been termed " the leader of the endocrine orchestra."

Goitre.—Any extraordinary enlargement of the thyroid gland is called goitre, and since the condition is so very evident, this type of ductless gland disease has perhaps received more attention

than the others. Another reason is that we know more about the thyroid secretion than we do about the other gland extracts. This being so the treatment is also in a more definite groove. The great stimulating properties of the combination of protein and iodide may be insufficient in one type of person, excessive in another, but a great deal depends upon the age of the person concerned. A very little shortage of the vital iodine will lead to goitre as a rule, but no two people react in the same way and thus great care must be taken in all cases of enlargement, which may be due either to want of work or to overwork of the tissues, or to increased physiological demands (e.g. in girls at puberty).

Simple goitre causes symptoms not due to increased production of thyroid extract but resulting from pressure on other structures. On examination of the gland there is found to be either an increase of the cellular elements or an overgrowth of the fibrous tissue. Cysts may also form. This type of goitre may be uncomplicated as we find it in various parts of England, Holland and America, and it is well known as "Derbyshire neck." But it may be associated with the deaf and dumb state, and with cretinism, which is described below, and in such circumstances it is found in mountainous regions like the Alps and Himalayas. Goitre has long been recognized as due to the absence of iodine from the drinking water, but we can now say also that absence of certain vitamins and phosphates and the presence of excess of maize, fat and lime in the diet are responsible. It must never be forgotten that a tainted well may be the cause of goitre. The chief symptoms are the unsightly swelling on the front of the neck, with dyspnoea and spasmodic cough.

Treatment.—Very often the simple boiling of the water is all that is required and when the dietetic defects are put right, the patient recovers, especially when she is young. Iodine and potassium iodide in various forms (salt, lozenges) are usually given and liquor iodi mitis may be painted on externally. Thyroid extract must be administered with great care. Partial removal of the gland is indicated when its size gives rise to symptoms of pressure, or when it becomes toxic. X-ray exposures usually have little effect.

Hyperthyroidism.—This is also known as Graves's disease and exophthalmic goitre.

The tendency to this disease is hereditary. It affects women more often than men (4:1) and occasionally children. The usual age incidence is between 20 to 40 years. The onset may be sudden or gradual and is often associated with physical or mental shock and prolonged worry. The actual cause has not yet been established, but the pituitary gland and other of the endocrines are also probably involved. A distinct type of individual is apt to develop this disease. She is usually a woman of spare build

with very fine straight hair and is often very active and intelligent.

Symptoms and Signs.—There is great loss of weight within a short time in spite of a voracious appetite. Tachycardia, sweating, tremor, muscular weakness, nervousness and restlessness are all signs of increased metabolic activity. (The metabolic rate may be increased to $+50$). The eyes are bright and staring and there is a lagging of the upper lids (von Graefe's sign) which makes the upper part of the cornea visible. In some cases diarrhoea is present. Glycosuria is occasionally observed and true diabetes may develop. The thyroid gland may be only slightly enlarged, but its secretion is increased in amount and is abnormal, resulting in the condition of thyrotoxicosis. The heart muscle is particularly sensitive to this, and if the disease is left untreated a condition of myocardial degeneration will develop, with all the signs of heart failure. A nodular goitre (thyroid adenoma) after giving no trouble for years may become toxic and produce symptoms of hyperthyroidism.

"Thyroid crises" may occur, in which the general condition deteriorates rapidly. The pulse rate rises to 160 or more, the temperature is raised, all other signs of hyperthyroidism become alarmingly pronounced and the patient may lapse into delirium and mania. The outlook in these cases is very poor.

Treatment.—Modern methods include x-ray therapy, operation (less resorted to nowadays) or purely medical treatment, according to the individual patient. Whichever method is used, however, the medical and nursing treatment is important, and much of the success of an operation depends on preoperative and postoperative medical care.

Rest is of great importance, but except in the most severe cases complete confinement to bed is not desirable. The patient should be allowed to go to the toilet and to sit out while her bed is made. This prevents muscles from becoming flabby and also dissipates some of the inordinate restlessness. Knitting and sewing should be encouraged within reasonable limits for the same reason. A medical ward is to be preferred even when operation is contemplated. A quiet corner should be chosen, if possible next to a companionable person. "Screening-off" is inadvisable as it makes the patient apprehensive. Visitors should not be too numerous and excitement must be avoided.

The food should be easily digested, but the diet should be generous, especially in fattening foods. Sweets and chocolate are excellent. Glucose is provided also in fruit drinks. The weight of the patient should be recorded weekly. It is a valuable indication of the improvement or otherwise of the condition.

The pulse rate should be charted every 4 hours and if treatment be satisfactory should show a steady decline, reaching the normal

in 2 to 3 weeks. When operation is decided upon it is usually performed soon after the pulse has become normal.

So far as medication is concerned iodides in some form are given, usually Lugol's iodine (5 minims) three times daily but for the 10-day period before operation only. Luminal, 1 grain twice a day, is prescribed as a sedative. Recently thiourea or its derivative thiouracil has been used. This inhibits the secretion of the thyroid and reduces its activity. It may be given as preoperative medication or continuously if operation is not performed. Results appear to be very good in most cases, although when the drug is discontinued symptoms of hyperthyroidism recur. There is also a small risk of agranulocytosis.

It is important in all nursing that complete confidence in the staff should be engendered. In cases of hyperthyroidism this is especially important, and the nurse should do everything possible to establish this confidence. If she is successful there will be no necessity when operation is undertaken for such clumsy procedures as "stealing the thyroid," which are psychologically unsound. They seldom really achieve their object of deceiving the patient and only make her more frightened and suspicious.

Myxoedema.—When there is defect of thyroid secretion resulting from disease (which is commonest in women between the ages of 30 and 50) the condition of hypothyroidism or myxoedema exists. There is marked atrophy of the thyroid gland and the only causes so far determined with any certainty are heredity and poverty. The symptoms are typical. The whole personality seems to change; coincident with a general slowing of the digestive and absorptive functions, of the activity of the muscles and of the work of the brain, there is a general thickening of all the tissues. There is usually no marked increase in weight, and there may be great under-nourishment. The appetite is poor and the myxoedematous person suffers greatly from cold. Anaemia is usually marked. The patient has a puffed-out, ungainly appearance, and with it goes a form or mental dullness that is more stupidity than anything else. The hair falls out, especially that of the eyebrows; the skin is dry and rough. When the condition results from removal of the thyroid gland by operation it is known as cachexia strumipriva.

Treatment.—The best way to understand myxoedema is to follow the patient as she undergoes a course of thyroid extract treatment which is regulated carefully according to the requirements of the individual. This is arrived at by estimation of the basal metabolic rate. Initial dosage should be rather below that known to be adequate and gradually increased. Some form of iron therapy should be given to counteract the anaemia. The effect is wonderful. All the weight seems to go from the body and mind. The former sluggard becomes active mentally

and physically and shows interest in life once more. The treatment must go on, of course, otherwise relapses are inevitable.

Cretinism.—In some cases there is absence of the thyroid gland at birth or if it is present the secretion is scanty. In either case the child suffers acutely from defective growth. Cretinism is a common cause of dwarfism and there are regions (Switzerland) in which there is always a certain percentage born with the defect. In some ways the symptoms are those of myxoedema, but the dwarfism accentuates the condition, the limbs being stunted and the face broad and puffy. The skin is dry and coarse and the abdomen is prominent; there is a waddling type of gait. In every respect cretins are difficult to manage. They have poor intelligence and therefore education is most difficult; in very bad cases the patients are idiots. If treatment by thyroid extract is begun early, fair results may be produced, but the difficulty is to discover the sufferers in time, to arrange for their transfer to a suitable area and to provide them with baths, massage and the exercises which are all so necessary.

Diseases of the Adrenal Glands

We know that the adrenal bodies are divided into two areas—the cortex and the medulla. Defects of the former may lead to premature senility, and tumours to complex sex alterations and hermaphroditism in adults. But the outstanding disease associated with adrenal defect is Addison's disease.

Addison's Disease.—Although this is a very rare condition it is so interesting that it merits careful consideration. It commonly affects men in their thirties, and on investigation four-fifths of the total of affected glands are found to be tubercular. Nowadays the evidence of the calcification of the capsule of the suprarenal gland is so clear that it can be demonstrated by x-ray. The symptoms produced are excessively low blood pressure, intense brown pigmentation of the skin amounting to bronzing and severe muscular weakness, in addition to general symptoms of an advanced asthenia. There may be severe vomiting and diarrhoea. The temperature is always subnormal. Survival is rare beyond 2 years, and often the patient dies in a few months.

Treatment.—The treatment of Addison's disease depends on the severity of the symptoms. Usually the administration of cortical extract or its synthetic equivalent is required. This is given either by intramuscular injection or by the implantation of small pellets which eliminate the necessity of frequent injections. They remain active for 2 or 3 months (p. 124). In addition to cortical therapy, large amounts of sodium chloride

are administered by mouth (about 5 grammes 3 times daily). If an "Addisonian crisis" develops during which there is an acute exacerbation of all symptoms, intravenous salines containing cortical extract, sodium chloride and dextrose are given.

The prognosis of Addison's disease was almost a hopeless one 10 years ago, but has improved considerably since the introduction of synthetic cortical extracts and the use of sodium chloride.

Diseases of the Pituitary Body

The nurse must keep in mind that when she is reading of the action of the various glands she is merely following the course of a very rapidly flowing river of knowledge. The information she obtains today may have to be altered tomorrow. This applies particularly to the pituitary body, that small and apparently insignificant gland situated at the base of the brain. Within the past 20 years a great deal of new understanding has been arrived at, and there seems to be no doubt that the next 20 years will be equally productive of fresh discovery. For its size the pituitary has amazing powers over the functions of the body; the consensus of opinion is that it is certainly the most important of the endocrine glands. Owing to the close relation of this gland with the diencephalon, or remnant of the primitive brain, it is not surprising that sleep, hunger, thirst and other important sensations should be controlled by it, or that the emotions, the autonomic actions and the general "traffic-control" of the mind and body should be under its influence. The symptoms of pituitary disease are therefore very mixed and it is most probable that ere long some more succinct classification will be devised. Meanwhile we can only refer to the established diseases.

Diseases of the Anterior Lobe.—Certain eosinophil cells produce an extract in this region. If these cells are in excess, we find that in children a state of gigantism, with precocious sexual development, is produced, while in adults the condition of acromegaly results. The latter is often ushered in by overgrowth of the hands and feet—the patient finds he requires bigger gloves or shoes. In time there occurs a general overgrowth of the bones, the face especially showing a prominent lower jaw. Intense headache is also a feature. When the cells are deficient, a most marked state of premature senility may be the result (progeria); the patients have the appearance of old men and women, although their age may be under 10. Another group of cells, which are associated with sex development, regulate the onset of puberty and the power of reproduction in both sexes. Finally, it is established that a third type of cell is responsible for fat control and other developmental features. When there is

disease of these cells the condition known as dystrophia adiposogenitalis is found; this is not uncommon. The cases show typical over-growth of the fat, with lack of development of the sexual organs and general evidences of unhealthy obesity. Undoubtedly the posterior lobe takes part in the causation also.

Diseases of the Posterior Lobe.—The posterior lobe produces an extract (pituitrin) which has already been discussed several times in this work. Its uses depend upon the nature of the action required—contraction of smooth muscle or raising of blood pressure. Too much pituitary extract in the blood causes interference with carbohydrate metabolism and the result is excess of sugar in the blood, with glycosuria.

Diabetes insipidus, a disease in which there is great thirst and passage of large amounts of pale watery urine free from albumin or sugar, is the direct result of pituitary disease. It responds well to injections of 1 c.cm. of pituitary extract given intramuscularly twice a day. The extract may also be sprayed with success into the upper parts of the nasal mucous membrane.

Diseases of the Thymus Gland

This gland, which progressively degenerates in normal children after the age of 2 years, may persist and form a swelling behind the manubrium of the sternum. In such conditions there is almost invariably an accompanying enlargement of the lymphatic glands, of the bone marrow areas and even of the thyroid gland. The great danger of this condition is that of sudden shock and death from syncope. The giving of chloroform is perhaps the most frequent stimulus to a fatal seizure, therefore all young children before having tonsils removed should be examined for enlargement of the thymus gland.

Diseases of the Parathyroid Glands

There are 2 diseases associated with the parathyroid glands. The first is tetany which is due to deficiency of parathormone, though other factors may also be concerned. This disease has been described on p. 323.

The second is osteitis fibrosa cystica which is due to an increase in parathormone and is most commonly caused by an adenoma of the parathyroids.

Parathormone, which is the secretion of the parathyroids, is largely responsible for calcium metabolism. An increase causes a great rarefaction of all the bones, easily seen in x-ray photographs. Cysts form in the shafts, and spontaneous fractures occur. The bones are soft and elastic owing to loss of calcium. The blood calcium content is high (over 10 milligrams per

cent) and some of the excess leaks into the urine and is excreted also in the faeces. In time there is great deformity and enfeeblement.

Effective treatment is operative; the tumour must be removed and the patient put into plaster until the bones harden. This is helped by a high calcium diet; calcium lactate is also administered orally. Success in these cases is one of the modern miracles of surgery, medicine and nursing skill.

CHAPTER 11

DISEASES OF THE LOCOMOTOR SYSTEM

SYNOVITIS. ACUTE ARTHRITIS. ARTHRITIS DEFORMANS. ACUTE RHEUMATISM. CAUSES. SYMPTOMS. TREATMENT. FIBROSITIS. TREATMENT.

In this chapter the purely medical as distinct from the surgical diseases of the muscles, tendons, joints and associated tissues are discussed. Dislocations, fractures, tuberculous arthritis and other conditions are dealt with in Vol. IV (Surgical Nursing).

Synovitis.—The membrane which lines the joint and which provides the interior with the lubricating synovial fluid, may become affected with acute or chronic recurrent swelling. In the latter case there is a swelling of the joint with increase in the synovial fluid, causing the patient to rest for a day or two. The attacks may come on every 2 weeks; there is no fever and no apparent constitutional disturbance. The condition is known as intermittent hydrarthrosis. The more acute condition is much more common. The knee joint is most frequently affected. It is often the result of a wrench or sprain, but may also be part and parcel of a rheumatic or gouty attack, while it very commonly follows gonorrhoea. It is more of a medical than a surgical disease in that it usually responds to conservative methods. On examination the joint is painfully swollen, and obviously the secretion from the synovial membrane is excessive, causing great internal pressure. The patient does not need to be told to rest the joint. Sometimes a splint is required, but usually the application of some soothing lotion, or of liquor of iodine or of an ice poultice, together with ample padding and bandaging, is sufficient to reduce the swelling and discomfort. The after-effects are stiffness and pain on movement, and a long course of massage and passive and active movements may be necessary. Generally there is some chronic recurrent stiffness which pulls the patient up suddenly on occasions when an extra strain is put on the limb.

Acute Arthritis.—It may be said that acute arthritis is an extension of the above but it may develop suddenly as part of a septic process and it involves every structure taking part in the joint, so that there is gross destruction owing to pus, and even

with the best results there is permanent defect of the joint action. In addition to the symptoms and signs described above, there may be rigors, collection of pus and dangerous general septic poisoning. As a rule surgical treatment is called for, the joint being opened and drained. The patient may be in bed for months. The sulphonamides have been used with success. Penicillin is effective in the treatment of acute gonorrhoeal arthritis.

Arthritis Deformans

In the chronic conditions of arthritis there are two well-defined groups, known respectively as rheumatoid arthritis and osteoarthritis. It may be that both are of rheumatic origin; much research is being done at present. Undoubtedly rheumatoid arthritis represents a much more acute condition than osteoarthritis but both are the result of long-continued irritation of the constituents of the joints. The distribution is wide; in addition to the joints of the hands and feet, the knees and the spinal joints may be affected. Arthritis deformans may be seen at all ages. In children, Still's disease, a state characterized by fever, splenic and glandular enlargement and anaemia, in addition to the swellings of the joints, is supposed to be closely allied to acute rheumatic conditions. Between the ages of 20 and 40, and commonly in the female sex, rheumatoid arthritis leads to spindle-shaped joints with swelling of the synovial membrane, and general swelling and effusion of the periarticular tissues, although the cartilage and bone are little affected. Bad teeth, septic tonsils, chronic vaginal discharge and other debilitating conditions may be responsible for the condition, but it may come on after a wetting or a chill. It leaves behind it contractures and deformities owing to rarefaction of all the tissues in the joint. Later on in life, another condition, possibly a phase of the same complaint—osteoarthritis—is found. This is the common condition of rheumatism associated with the fifties and sixties. The causative factors are as above. No doubt a common rheumatism organism will be discovered soon and this will put an end to all the controversies, but there is ample proof that rheumatoid arthritis and osteoarthritis show features common to each other. In chronic osteoarthritis, injury, occupation, habit, heredity and general debility must all be considered in the aetiology. The affected joints show erosion of the cartilages, a highly polished " wear " of the ends of the bone and actual wasting of the bone, but the joints may have a lip or rim of nodular overgrowths and loose bodies may exist in the joints. In the spine the bones occasionally fuse together, but in the limbs the main cause of immobility is interlocking. Old men and women

commonly suffer from a so-called "rheum," which is a chronic condition involving one joint only, usually the hip or the shoulder. The spine may be stiffened permanently in the condition of spondylitis deformans.

Symptoms.—Rheumatoid arthritis begins as an acute arthritic condition and the disease causes severe pain and swelling in the affected joints. Recurrences are frequent, the deformities becoming more accentuated with the years. The hands and feet develop the characteristic ungainly, twisted claw-like appearance and all movement is limited. Muscle degeneration and trophic changes occur. The other condition, osteoarthritis, begins less dramatically but slowly progresses with stiffness and growing deformity. The ends of the bones at the joints are typically "knobby," there being some creaking on movement. All stages are seen, from slight swelling with stiffness to the most marked derangement of the normal outline.

Treatment.—Any bad teeth or septic tonsils should be removed. Potassium iodide is the most successful drug for the rheumatoid cases, but the best we can do for the more aged patients is to keep them warm in bed, free from chills, and to give them aspirin or its allies. Intravenous gold injections are sometimes beneficial, but a careful watch on the urine must be made and at any sign of albuminuria the drug should be stopped. Permanent kidney damage can occur as the result of indiscriminate medication. Electrical treatment by diathermy, removal to a pleasant climate, ample clothing and all kinds of balneological therapy are more modern forms of treatment. It has been well said that fashion plays an important part. Vaccines have had a mixed success. Massage, ultra-violet light, infra-red rays, galvanism and faradism must all have their turn too. Even radium is recommended, and blood transfusion and deep x-ray therapy for the rheumatoid and osteoarthritic conditions respectively.

Acute Rheumatism

Acute rheumatism (rheumatic fever) is a disease which must be distinguished from the so-called rheumatism that is used by many people as the "dump" of all the chronic aches and pains of the body which affect human beings at all periods of life, but chiefly in old age. For nearly half a century a vigorous research has been going on to try to discover the organism which is at the root of acute rheumatism. Progress has been very slow, however, and it is still impossible to make any classification to comprise all the types of acute and chronic rheumatism although there are apparently associated bacterial elements in the aetiology of all of these. We appear to be on the eve of some more comprehensive

understanding and it is very likely that the whole subject of rheumatism, acute and chronic, may soon be dealt with under the general heading of the rheumatic diseases.

Causes.—Rheumatic fever is undoubtedly an infectious disease, with a very acute course in one type of case and an equally serious but less demonstrative course in another. The latter variety is usually referred to as the subacute type, while the former is regarded as rheumatic fever proper. If we accept the findings of the experts we may look upon these two more dramatic expressions as the maximum reaction to the organism in its most virulent form, since it is evident that the degree of seriousness depends upon the amount of sensitization of the victim.

First and foremost then, we must put the blame on the elusive bacterium, alleged to be a streptococcus, but a rather mysterious streptococcus, in that it is a quick-change artist and varies widely in its disguises. There is nearly always a preliminary sore throat and sometimes tonsillitis, otitis and pharyngitis, but often nothing more than a mild cold in the head which in a child may be regarded as an ordinary occurrence. This preliminary stage is very important, since it may be followed 1 to 3 weeks later by all the signs of severe rheumatic fever. The important point is that in the interval the child may not show a single sign of anything being wrong. The blood tests are the only positive factors and they are rarely done, since the doctor may not be in attendance. The present theory is that the microbes, harmless enough in the throat, send powerful toxins by the blood to the tissues, and thus after a period (possibly in which there has been a succession of sore throats), the child is so strongly sensitive to these poisons that his whole resistance eventually breaks down and he is laid low by rheumatic fever.

Symptoms.—The great feature of the disease is the toxic influence at work. This may produce the acute type of fever, commonest in males between 12 and 35 and characterized by agonizing pain in one joint (usually the knee), with swelling, heat, tenderness, high fever and even rigors and a temperature of 107° F., accompanied by excessive sweating with sour and offensive perspiration. The tongue is so thickly coated with dirty matter that it is commonly referred to as the "blanket tongue." There is great weakness and depression, with marked anaemia. Ultimately the complications described below supervene, and often cause chronic constitutional weakness.

Children from 4 to 12 are usually affected somewhat differently. We have spoken of the apparent triviality of the initial throat changes. In the train of these there may be complaint of pains in the joints, often dismissed lightly as "growing pains." Often it is only after careful investigation in hospital that these

cases are proved to be serious. There may be no fever at all but as a rule the child is dull, lethargic and very easily tired. His nervousness may make the pulse rate high, therefore the pulse should be taken during sleep and it will always be found to be over the normal daily rate. In the region of the painful joints, in the neck, head and elsewhere, nodules varying from the size of a millet seed to the size of a pea may be found. The weight progressively diminishes, and the child shows every sign of being debilitated. The modern method of blood testing, however, will show increased vulnerability to the rheumatic organism, and later on when the classical complications common to all types of acute and subacute rheumatism occur, the full damage is apparent. These complications are pericarditis, myocarditis, endocarditis, pleurisy, various skin troubles, serious tonsillitis and meningitis. Most of them have been dealt with in previous chapters, so that the nurse must already be fully aware of their gravity. Children especially develop chorea. One hundred children out of every 12,500 die every year from rheumatic fever. This is to be deplored, but a lowering of the rate cannot be obtained until we eliminate the strong hereditary factor and that seems to depend upon complete eradication of the slums and with them all the problems of nutrition, hygiene, lack of sun, presence of damp and all the other factors of a life of squalor. At present only the preliminary steps have been taken; it will be many years before the harvest is reaped, especially as the provision of houses has been limited by post-war economic difficulties.

In both children and adults the disease is noted for the way in which the inflammation flits from joint to joint and for the number of relapses which occur, often without much demonstration of symptoms. Of all the diseases rheumatic fever is probably the one outstanding ailment in which there may be very little to find in the symptoms to account for the disastrous activities going on in all the vital organs.

Treatment.—Nurses will realize that the treatment of such a severe condition requires great concentration of energy. The primary essential is prolonged rest and this is brought about by having the patient lying flat in bed with one small pillow for the head. In adults it is frequently advisable to keep the patient in bed for 6 weeks after all acute signs have passed off. In the case of children the convalescent period is so important that in most communities the local authorities have a system of convalescent treatment in which the child is sent for several months to a country home. There is ample supervision of the disease in such circumstances but at the same time, the child is well fed and gradually hardened to ordinary life, while educational facilities are provided. Constant review of such cases is essential for many years afterwards.

The local treatment depends upon the degree of the swelling and pain. Most of the joints are so tender that the slightest movement of the bed sets up a spell of agony, therefore the joints should be well wrapped up in cotton wool and protected by a cage. It may be necessary to apply soothing liniments or fomentations. The general treatment consists in nursing the patient between blankets, which should be frequently changed, as they become saturated with clammy, offensive sweat. The patient should wear a flannel nightgown. Despite all the modern drugs, the old-fashioned salicylate of sodium remains supreme as the remedy. In some cases the tonsils may be removed, but only after the most careful summing up of pros and cons. Vaccine treatment has had poor results so far. The diet in the acute stage should consist of milk, chicken, tea and fruit jellies. Meat at all times should be very restricted.

A final observation to be made refers to the sulphonamides which are of no value once the disease is established. Persons subject to recurrent attacks of acute rheumatism are sometimes given small doses of the drug as a prophylactic measure. This has its dangers, however, since toxic reactions are not uncommon.

The solution of the whole problem of acute rheumatism will be furnished when conclusive evidence of the specific organism is produced, after which scientific treatment by appropriate antitoxins should be possible. Meanwhile we are forced to proceed on more or less arbitrary lines.

Fibrositis

This complaint, which is very common and which is supposed to be due to some influence analogous to rheumatism of chronic type, is discussed at this point, since for all practical purposes it can only be classified as a rheumatic disease.

Fibrositis is a painful inflammation affecting the fibrous tissue, and therefore it may be found in various forms in the muscles, fascial tissues, ligaments and tendon sheaths. Myalgia is a more popular name for it. The causes are a damp atmosphere, cold, sitting about with wet feet or in wet clothes, draughts, debility, poverty and poor nourishment. But it may affect anybody who is debilitated, no matter to what class of society he may belong. A vigorous athlete who has been subjected to severe physical strain may have an aftermath of lumbago; the prosperous tradesman may develop a stiff neck as a result of standing at his counter in a constant draught. There are 3 chief varieties of fibrositis.

1. *Lumbago.*—This is a painful inflammation of the lumbo-muscles, resulting in stiffness and limited movement. It may

come on suddenly after exposure to the elements, in which case the patient awakes in the morning and feels his back painful and stiff. The condition eases somewhat during the day but returns with vigour in the evening. Another type of lumbago begins very suddenly, especially in old men, who may try to lift a heavy weight or perform other feats of a more youthful age; a sharp stabbing pain pulls them up, and they are affected by severe pain and stiffness for several days afterwards.

2. *Stiff Neck.*—Sometimes children become afflicted with this painful trouble, which must not be confused with torticollis. Adults may also be affected after long spells of holding the head in a certain way e.g. watching a display of flying.

3. *Pleurodynia.*—A sudden pain in the chest, often confused with pleurisy, but having none of the true symptoms, is termed for want of a better name, pleurodynia. It is a myalgia of the intercostal muscles, usually of one side only, but the sheaths of the pectoral and serrati muscles may participate. Breathing is painful and difficult, but the pain is not sharp and lancinating, as found in pleurisy.

Treatment.—Complete rest to begin with, with the application of soothing lotions or poultices, or with immobilization by strapping, is indicated. As time goes by the muscles may be cleared and stimulated by massage in which various embrocations and oils are used. For the very chronic deep seated and freely recurrent fibrositis, diathermy is outstandingly successful. The diet should be light and the bowels should be treated with mercurials and salines. Medicines such as salicylates and iodides are in common use. Any bad teeth or other septic focus should have attention. Spa treatment in all its aspects is always worth consideration.

CHAPTER 12

INFECTIOUS DISEASES—A GENERAL SURVEY

DEFENSIVE MECHANISM OF THE BODY. IMMUNITY. SERUM AND VACCINE THERAPY. SUMMARY OF THE VARIOUS METHODS OF IMMUNIZATION. TREATMENTS AVAILABLE. ANAPHYLAXIS. SERUM SICKNESS. FEVER. GENERAL PRINCIPLES OF FEVER TREATMENT. THE MAIN SYMPTOMS. TYPES OF FEVER. DELIRIUM. SPECIAL TREATMENT OF FEVER. INCUBATION PERIODS. PRECAUTIONS AGAINST TRANSMISSION. NOTIFICATION OF INFECTIOUS DISEASES. SUPERVISION. TREATMENT OF THE PATIENT IN HOSPITAL. INFECTIOUS DISEASE BREAKING OUT IN A GENERAL HOSPITAL. TREATMENT OF THE PATIENT AT HOME. CONTACTS. FINAL DISINFECTION. DEATH.

THE first lesson to be learned in the study of the infectious diseases is one which explains the general process of infection. If a sound knowledge is gained of the activities of the bacteria and of the reaction of the tissues of the body to them it will be an easy matter to apply that general knowledge to the individual infectious disease. All of the latter type conform in a certain way to a common plan or routine. Their special characteristics may be due both to the micro-organism responsible and to the reaction of the tissues.

Defensive Mechanism of the Body.—In Vol. II, Section IV, there is given an outline of the infectious process, including the nature of infection, the various types of bacteria, the effect of bacterial invasion of the body, the course of a typical fever, the source of infection, the mode of transmission and the working of the defence mechanism and various other subjects which are grouped under the heading of Bacteriology.

On account of the fact that the infectious diseases have an importance peculiar to themselves and that brief recapitulation of certain points will be helpful at this stage, a few essential factors are again discussed in the belief that such revision will make understanding of the subsequent chapters easier.

Normally, we may conceive the body as composed of millions of cells, each provided with a certain protective outfit. This may be some form of armour—perhaps a specially resistant envelope

or some other mechanical bulwark against attack. But research has proved that the cells of the body do not depend so much upon their passive armaments as upon their active weapons. The cell maintains its integrity by a constant policy of aggression, this being accomplished by the manufacture, in each cell, of a certain chemical substance antagonistic to germs and known as the antibody. This word frequently occurs in medical literature and it is always to be understood as the instrument with which the cell fights for its very life. In addition to the power possessed by the cell there is the reserve of special police of the blood—the leucocytes. We have learned that the white blood cells act as a mobile unit, keeping the blood and the rest of the body free from the poisons of disease. Their action is simple enough, and easily understood. They devour the organisms with an amoeboid action, and break them up by digestion. This is called phagocytosis; normally this process must go on to a certain extent in the healthy state, otherwise we should quickly succumb. But when there is a mass attack of bacteria, more leucocytes are required at short notice, and the body has the power of rushing reserves to all parts of the circulatory system. When a blood count in health is taken, it is found that on the average there are about 7,500 white blood corpuscles in every cubic millimetre of blood. In certain fevers, there may be 35,000 leucocytes in the same space, the process being known as leucocytosis.

Despite all the efforts of the white blood cells in the two reactions of leucocytosis and phagocytosis, it may be that the organism is too virulent or, as the technical expression is, excessively toxic. Toxin is the weapon used by all microbes; it is something very antagonistic to the human protoplasm, an agent which acts like poison gas or a high explosive. Everywhere it causes disintegration of the structure and in the long run leads to gangrene (death) of the tissue. In this battle we can imagine each leucocyte literally gobbling up the microbe and putting its adversary out of the fight. We do not know how great is the capacity of each phagocyte, but it is certain that in the majority of cases the white blood cells commit heroic suicide to save the human beings from complete domination. A collection of dead leucocytes is discharged from an abscess as pus; these are the casualties of the battle. It must again be stressed that everything depends upon the supply of fresh leucocytes if the protection of the individual is to be made secure. In general blood poisoning there is a condition in which the bacteria have overcome the leucocytes and they multiply freely in all directions, pouring out their toxins over a defenceless land. If the toxin reaches a certain concentration, the creature himself dies as his phagocytes have died before him. This in brief is the whole tragedy of fatal sepsis.

Now the other cells of the body do not remain passive during this battle. All have the antibodies as their guards, and immediately a microbic attack is launched these multiply rapidly and are poured out into the blood stream, thus making the medium much more unpleasant for the invaders. There are various theories as to the action of the antibodies. The bacteria are countered by various devices, just as in war an enemy is fought with infantry, machine-guns, artillery, shrapnel and even gas. The simplest action is one of neutralization of the toxin by an antitoxin, i.e. some substance that acts in the same way as an acid acts on an alkali, producing a harmless salt. Another method is that of the opsonins, so-called because they "prepare the feast," the word being derived from the Greek; opsonins exist in the serum and probably act as the sauce for the microbic goose, since they seem to make the organisms more easily engorged by the leucocyctes. A third system depends upon the formation of an adhesive medium which causes the invaders to become attached to each other in groups (agglutination). Finally there is a complex method of actually breaking up the microbe, this being accomplished by an agent known as bacteriolysin, which must, however, have two companions in the fight, one called the complement, and another, derived from protected serum, called the immune body. All the above devices are employed in the fight against disease and are known collectively as the defensive mechanism of the body. The state of being protected is known as immunity.

Immunity.—When a human being is surrounded by micro-organisms, is inhaling them, touching them and swallowing them, and yet does not show any evidences of a reaction to the mixed or specific microbes at work, he is said to be immune. It is obvious from what has been said above that immunity is an absolute term, depending upon the completely protective powers of the individual, but it can be classified first as natural, due to inherent powers of resistance, or as acquired, the result of active production of antibodies by the person during an attack. Active or passive protection may be obtained also, after the artificial inoculation of the tissues and blood with a prepared culture or an antitoxin (see below). It must now be clear to the nurse that the simple hygienic rules we stressed in the earlier part of this work were framed to increase and to maintain the natural immunity so that a strong first line of defence would be available in bacterial attacks. In addition to this, however, it is essential to have a strong reserve line by making available the forces of active acquired immunity, the maximum army we can put into the field to supplement our regular army. Lastly, when this is not sufficient we can call out our very powerful allies in the form of artificial antitoxins which are introduced into the blood by the

hypodermic needle. The time selected for the launching of this last counter-attack may vary; nowadays it is possible to anticipate disease and protect the human being in advance so that the attacking forces are battered against impregnable forts and concrete walls. Immunity production has become a well developed craft of medicine.

Serum and Vaccine Therapy.—With the above knowledge at our disposal, it is natural that we should seek to take full advantage of our understanding of the defensive process. There has gradually developed a great branch of preventive, diagnostic and curative medicine based on the uses of bacterial essences and chemical antitoxins. There is hardly a single being alive today who, at one time or another, has not been vaccinated or inoculated or injected for some disease. Tests can be made of the blood when there is a suspicion of active powers of destruction at work. The counting of the white blood cells is an everyday occurrence of the doctor's life, especially in hospitals. A rise of the number (leucocytosis) is almost invariably the sign of danger; a fall has equal significance. The blood can be tested by various methods for disease, the positive reactions being indicated by evidence of agglutination and other phenomena. Later on we shall see how it is possible to determine actually the strength of the patient's response to scarlet fever, diphtheria and other infections and to give immunizing doses as a preventative. We can examine the blood and find in a given disease how much relish there is on the part of the leucocyctes for bacteria—estimation of the opsonic index. The latter may be improved by giving vaccine treatment, which is dealt with below.

Summary of the Various Methods of Immunization.—At this point it is convenient to make a categorical list of all the methods available in the branch of treatment under consideration. Only those of established use are mentioned and it must be remembered that there are numerous variations, depending upon the patient and upon the doctor in charge. In all microbic attacks, therefore, we have the following remedies.

A. *Natural Immunity:* the natural defence peculiar to each individual.

B. *Acquired Immunity:* the increase of defence forces as a result of illness.

C. *Acquired Artificial Immunity:* by extra forces introduced from outside the body.

(*a*) *Active.*

1. Induced by injecting weakened organisms into the blood at intervals and so causing natural response of antibodies.

2. Induced by giving injections of safe amounts of full-power bacteria.
3. By inoculation with regular doses of dead bacteria.
4. By injection of a non-fatal amount of the bacterial toxin, freed from germs by filtration.

In active immunity the theory is that as we continue to put more and more organisms or toxins into the blood, therefore more and more supply of antibody is produced, this having effect for a long time afterwards and protecting the individual.

(*b*) *Passive.*

1. By using antitoxic serum i.e. serum drawn from an animal (e.g. the horse) which has been actively immunized as above by being given injections of toxin.
2. By using antibacterial serum, from animals inoculated by the methods (*a*) 1, 2, or 3 above.

[N.B.—(*b*) 1 and 2 have specialized action respectively on the toxins alone and on the bacteria alone. Every individual bacterium has its specific toxin for which there is a specific antibody. In the case of the toxins being contained in the envelope of the cell while the organism is alive, we must fight the invasion with anti-bacterial serum; on the contrary when the toxins are discharged into the blood by the bacterium we have to use the antitoxic serum, which acts in the way described above by neutralizing the poison. In the case of the bacteriolysin action, we find that opsonins and agglutinins participate.]

It is thus clear that in fighting the bacterium all the methods mentioned above may be employed; in practice we must supply the antidote which is most deficient.

Thus after measles, scarlet fever or whooping cough, the patient is protected for a certain time against a recurrence; he can move into areas in which these diseases are rife and remain unharmed. This is the effect of acquired immunity. Against smallpox and rabies the individual may be protected by the method (*a*) 1 (vaccination). Against the common cold, plague, typhoid fever, cholera and various other diseases, the method (*a*) 3 is the most suitable (vaccine treatment). In the latter, a culture of organisms is grown and the number in a drop is estimated. By diluting greatly with normal saline solution and by killing the organisms by heat, a mixture called the emulsion is produced, each volume containing a known amount of dead bacteria. Carefully measured doses of the vaccine can thus be supplied in small glass phials and inoculation is done by hypodermic injection. There is a great vogue for this type of treatment nowadays, both as a preventive and as a therapeutic measure. Many vaccines are used from stock, obtained from patient with a typical attack of the disease in question, but

most are prepared by taking a sample of the patient's organisms, by making a pure culture and then by mixing up an emulsion of appropriate strength. This is known as an autogenous vaccine. Against diphtheria or scarlet fever we may use either the bacterial toxin (*a*) 4 or the antitoxin (*b*) 1. These methods are fully discussed under the headings of Diphtheria and Scarlet Fever.

Treatments Available.—Our knowledge of the powers at our disposal is still very much in the primitive stages, but within the past 10 years great strides have been taken and still greater progress may be expected. So far, however, we can make use of the following remedies.

1. *Chemotherapy.*—During the last decade, a tremendous advance has been made in the treatment of many infections by the use of sulphonamides and penicillin. These drugs have certainly superseded other forms of therapy in some cases, and have reduced the number of diseases for which there was no specific remedy. It must not be imagined, however, that they are a cure for all ills or that previously well tried methods are now of no account.

2. *Antibacterial Sera.*—In various conditions in which the bacterium is known to have an endotoxic (or retained toxin) action. It is usual to supply a mixed or polyvalent serum for this condition (e.g. in dysentery).

3. *Antitoxic Sera.*—These are used chiefly in diphtheria and tetanus; they neutralize the poisons.

4. *Vaccines.*—Vaccines may be given in active disease, as already mentioned. The opsonic index should first be estimated. In all conditions of small boils, pustules, septic foci on the skin and so on, vaccine treatment, autogenous or stock, is successful as a rule. Vaccines may be sensitized, i.e. exposed to immunized serum and then washed free of it. This has the effect of increasing the length of the subsequent immunity and of diminishing the reactions. Another form of vaccine is the detoxicated vaccine, in which the bacteria have had their contained poisons removed, but the framework of the organism is left intact. By this method a greater number of germs can be inoculated at a time and a more speedy immunity results.

Anaphylaxis.—This condition and that of serum sickness mentioned below are possibilities in antitoxic methods of treatment. Anaphylaxis is a stage of the cells in which there is apparently a supersensitivity owing to the fact that a bacterium or its toxin, when introduced into the human blood serum, makes the patient so sensitive that when, after about a fortnight, a second dose of the same bacterial serum is given, it may cause a condition of increased pulse, difficulty of breathing or in serious case severe shock, but death is rare.

Serum Sickness.—Within 8 to 12 days after antitoxic serum has been given, the patient may have a slight rise of temperature, a blotchy red rash, sickness and swelling of the lymphatic glands. The attack passes off in a few days. Despite the fact that patients may escape this first seizure, there is always the possibility of a delayed attack, very much akin to anaphylaxis, which may come on if the 2nd dose is given from 12 days to 6 months afterwards. These dangers may be reduced greatly by careful investigation of the patient's peculiarities, especially when there is an asthmatic tendency and by using sera which have been reduced to the minimum content of protein element.

Fever

Some error is committed in using the word, fever, which properly should refer to the state of pyrexia. But custom dies hard, and so today, despite all our scientific rectitude, we still say a person has "a fever," when we really mean that he is afflicted with a specific infectious disease. We have already investigated the process of infection (Vol. II, Section IV), but the fevers belong to a more restricted group. In nearly every case they have pyrexia as their outstanding symptom; they are caused by a specific germ, parasite or virus, and in cases in which no causative agent has been found it is assumed that the organism is too small to be seen, since it is said to pass through the finest bacterial filters. Fevers may be exanthematous, i.e. accompanied by a typical rash, they may be transmitted from man to man or from animal to man, and the method of their transmission may be by direct contact with a person, by air, by carriers and by clothing, books or fabrics. The best way to regard the infectious fevers is to imagine them as the special method of response adopted by the individual to overcome the attack of the microbes foreign to his blood. Thus the peculiarities of each microbe will account for the particular form of the symptoms and signs of the associated "fever." If all that has been written about immunity above is fully understood there need be no misunderstanding of the process in action.

Fundamentally the process of fever depends upon the upsetting of the heat regulation centre, presumably owing to poisoning of the blood by bacteria. Associated with this is a train of symptoms that might be expected to happen when we consider that the warmth of the body has been increased and the fuel is burning more brightly than usual. There is more wear and tear, more wastage and more demand for cooling agents. We must imagine that the battle which is proceeding between the offensive bacteria and the defensive cells is literally a hot one, and the smoke of battle is represented by rise of temperature,

dryness of the skin and mucous membranes, scanty flow of urine, constipation, derangement of the digestive and absorptive systems and even interference with the nervous system.

From what has been said previously about the activities of micro-organisms, and about the stages of incubation, invasion, fever proper (or fastigium) and crisis or lysis, we can clearly see that it is proved that a specific infectious disease is not the actual demonstration of the poisoning process but rather the evidence of the reply made by the extraordinary defences of the body to the foreign invader as stated above; thus the greater the response of the individual, as shown by high temperature, rapid pulse and general signs of activity, the better the outlook. In a case like this we may be sure that the bacterium is getting the worst of the battle and the old saying of "the hotter war, the sooner peace" holds good; when the convalescent stage is reached the patient will be well supplied with antibodies for many a long day. But when a person of poor physique, or a senile patient, is suffering from a serious fever such as pneumonia and responds very feebly with perhaps a temperature of 100° F. and a pulse of 90, we must look out for trouble. These are the patients who require the maximum effort on our part.

General Principles of Fever Treatment.—As a result of our knowledge of bacteria and their ways and of the defensive mechanism of the body, we can formulate definite principles in a plan of campaign which may be followed in all infectious diseases. First of all we can reduce in a general way the tendency to infectious disease by improving the individual and by improving his environment. Both these factors have been fully discussed in the Hygiene section and need no further emphasis. Suppose, however, that a certain number of organisms of infectious disease are inevitable in our midst, and suppose they succeed in entering the body. What are we to do? We can attack the organism by making things so uncomfortable for it that it cannot live. In order to destroy ruthlessly every microbe that can be destroyed we must keep the patient's blood charged with antibodies, antitoxins and counteracting sera. We must promote also the maximum effort on the part of the individual in the destruction of the bacteria by stimulating his cells by drugs, tonics, food and water, by using antiseptics and by nursing the patient so that his strength is not allowed to be wasted in useless work. Even although it is possible, therefore, with the modern adjuncts at our disposal to limit the onset of fever, we must put out every effort when we are confronted with a case so that it may be aborted in the shortest possible time.

The Main Symptoms.—In the next few chapters is given an outline of the main features of the better known infectious

diseases, but nurses should understand that there are many signs common to all fevers, and it will make things easier later on if we now enumerate briefly the outstanding symptoms of the fevered state.

The features may be studied as they occur during the various stages. In the pre-fever period of incubation, there is often a general and indescribable irritability and abnormality of the mind. The patient may be pale, listless, difficult to deal with; constipation and loss of appetite generally lead the mother to conclude that the child is "sickening for something." During the period of invasion the metabolism is upset, the patient often being sick, and as the temperature mounts up, rigors, convulsions or shivering may send the patient to bed. In the next period of the fastigium, or exhibition of the fever at its zenith, we generally find that the rash ushers in the classical state of fever in which the temperature remains high, the skin is covered with a rash, the bowels are constipated, the urine is reduced in quantity and is highly coloured, the patient suffers from thirst, the skin and mucous membranes are hot and dry despite the increase of sweating and general toxaemia is demonstrated by headache, delirium, coma or dangerous collapse. The pulse and the respirations are increased. The battle is on and it is a question as to the ultimate conquest, since the individual, in exerting all his efforts, puts a strain on every organ and may cause permanent damage (e.g. to the kidneys) in his attempt to get rid of the toxic elements with which he is surrounded, and he may not be able to last out against such powerful adversaries. At the same time we must imagine that the microbe does not have its troubles to seek; beset on all sides by antibodies and antitoxins, it may soon succumb, after which the stage of defervescence begins. This stage may be short or long, according to the fight put up by the dying microbes. In pneumonia for instance the change is rapidly accomplished in a few hours—the characteristic crisis. In typhoid fever on the other hand the fever may gradually decline, taking some days over the process; this is called lysis. Finally there is the convalescent period, perhaps the most important of all, since it is essential that the patient should have ample time to recover and abundant opportunity to patch up his worn-out defences, before he submits himself once more to the rough and tumble of everyday life.

The Typhoid State.—In certain forms of enteric fever, a state of collapse takes place during the 3rd week of the disease. This is so typical of typhoid fever that the name, typhoid state, has been given to it, but as this condition may supervene on any active fevered state apart from enteric fever we must study its features at this point. It may be found in pneumonia, in smallpox, in typhus fever and in certain other infectious diseases.

The points to note are that the patient suddenly seems to lose his fighting capabilities; he begins to lie down to the disease. Mentally and physically he is negative. On the mental side, he becomes dull, heavy and in a semi-comatose state. He has widely dilated pupils and his eyes remain open whilst sleeping (a condition known as coma vigil and very alarming) but he is almost blind. He slips to the foot of the bed and picks at the bedclothes with his fingers in a most deliberative way, and all the time he keeps up a conversation with himself in low muttering delirium. The physical aspect shows equal depression. The muscles are flabby, soft and tremulous, while the pulse is weak, rapid and easily compressible. The mouth is in a terrible condition of unhealthiness. Unless constant attention has been paid to them, the teeth and the lips become coated with sordes, a mixture of bacteria and dried mucus and saliva, and the tongue is yellowish-brown, furred, dry and " lazy " in its movements; the tremor is marked when the patient attempts to protrude it. The typhoid state very often is the forerunner of a fatal end.

Types of Fever.—The temperature chart is always of great importance, but in the infectious fevers it is an invaluable record of the course of the disease, as well as a help in the accurate diagnosis of the condition. We say that fever is continued, remittent or intermittent (see Vol. II, pp. 326–328).

Continued fever is fever which remains above normal for several days on end, with a daily variation amounting to about one degree. Examples smallpox, pneumonia.

Remittent fever is fever which " swings " during the day, i.e. there is a wide variation (often 3 to 4 degrees) between the morning and evening temperature. At no time, however, does the temperature drop below normal. Examples: phthisis, sepsis.

Intermittent fever: in this case, there is considerable " swing," but the temperature does fall below the normal line at some part of the day. Examples: malaria and other tropical diseases, severe blood poisoning.

In somes cases of phthisis, we find that the temperature instead of going up at night, rises in the morning. This is known as typus inversus. The onset of many fevers is sudden (pneumonia, for example) but in enteric fever the disease comes on and disappears by a ladder process of climbing and descending temperature. All the above types are fully discussed in Vol. II, Section VI, Chapter 6.

Delirium.—Although delirium is a nervous sign, it occurs so often in the course of fevers that it is nearly always described under this heading. It is evidence of loss of cerebral control, and may range from the wild raving and violent muscular

demonstration of the maniac to the delirium mentioned under the heading of the typhoid state. Delirium tremens is associated with constant overindulgence in alcohol; so long as there is no strain on the physique, such mental derangements need not occur, but if pneumonia or even a slight illness should come on, the patient at once becomes restless, tremulous and wandering in his mind, hearing things and seeing things, usually of a grotesque nature, which are obviously non-existent. The treatment of such conditions depends upon the case. So far as the nurse is concerned the application of the various forms of cold to the head may be of great use, but the main factor in the handling of the situation is the proper use of the drug prescribed, and whether it be sedative or stimulant it must act speedily.

Special Treatment of Fever.—The general principles governing the treatment of fever have been mentioned above. The practical application of these must be reviewed. We may dismiss in a few words the essential hygienic measures which apply to all diseases of an infectious type. Fresh air, simplicity of furniture and a system of constant and complete disinfection should be the guiding lines of the sickroom. The drugs used are those which tend to reduce the temperature and include the antipyrin, salicylate and quinine groups as well as many others. These act directly on the heat-producing centres. But we can also reduce heat by giving drugs which will cause increased loss of fluid from the body—the diaphoretics and diuretics. In order to reduce the strain on the glands and special secreting organs we must give abundance of fluids and reduce the diet considerably, leaving out the proteins as much as possible. A mixture of milk and soda water ice-cold is a universal favourite in acute fever, while glucose is also in common use The bowels should be kept loose by salines, but the action should not be such that it leads to fatigue or collapse. Stimulants such as alcohol in the form of brandy or champagne (both in great moderation), digitalis, strychnine and other drugs are all valuable in keeping up the strength of the heart. In addition to all these methods there is a host of nursing procedures which have already been dealt with in Sections VI and VII, and which help to reduce the temperature by the application of cold or even of heat in various forms.

Incubation Periods.—Although there is great divergence of opinion regarding the incubation periods of the various infectious diseases, the following may be taken as the average number of days which pass from the date of the arrival of the micro-organisms until the first symptoms appear.

Enteric fever	10 to 14 days
Scarlet fever	1 ,, 8 ,,
Measles	7 ,, 14 ,,

Mumps	4 to 28 days.
Smallpox	10 ,, 14 ,,
Chickenpox	11 ,, 21 ,,
Whooping-cough	6 ,, 18 ,,
Diphtheria	2 ,, 10 ,,
Tetanus	2 ,, 14 ,,
Cerebrospinal meningitis	1 ,, 5 ,,
Encephalitis lethargica	7 ,, 14 ,,
Poliomyelitis	1 ,, 14 ,,
Septicaemia	variable.
Puerperal septicaemia	1 to 5 days.
Syphilis	variable.
Tuberculosis	,,
Influenza	1 to 6 days.

Precautions against Transmission

To a certain extent, this subject has been treated in Section III, but a more comprehensive survey must now be made of the various ways in which personal and communal hygienic measures are adopted to limit the spread of an infectious disease.

Notification of Infectious Diseases.—By law, it is incumbent upon the doctor to send to the local Medical Officer of Health a certificate stating the nature of the ailment and giving other particulars when an infectious disease occurs in a family. As a general rule, the following diseases appear on the list, but variations may occur according to the district in which the patient resides:

Smallpox, cholera, diphtheria, membranous croup, erysipelas, scarlet fever, typhus fever, enteric fever, relapsing fever, continued fever, puerperal fever, chickenpox, measles, German measles, whooping cough, plague, cerebrospinal fever, poliomyelitis, acute encephalitis lethargica, acute polioencephalitis, tuberculosis, ophthalmia neonatorum, dysentery, malaria, acute primary pneumonia, acute influenzal pneumonia and anthrax.

Supervision.—As a general routine, the local Medical Officer of Health keeps an official eye on the case from start to finish. In most cases he instructs his sanitary staff to call at the house, and to give advice about disinfection, isolation and quarantine, He is at the disposal of the practitioner as a consultant if any difficult point should arise and full advantage is usually taken of his skilled advice. Our modern fever hospitals are so well equipped that it is advisable, whenever possible, that the patient should be sent there, and this simplifies matters. Assuming that this has been accomplished, the people who have been in close contact with the patient must be kept under supervision for a certain period until it is certain that they are not also going to have the disease. Such persons are known as contacts: in some cases the throat may have to be swabbed on several occasions or an examination made of the excretions before these contacts are

allowed to mix with other people. Disinfection is carried out by the use of the fumigation method and by lavish employment of antiseptics. All paper and other negligible articles are burned, and bed-clothes, curtains, clothing and so on are removed to the central disinfecting station and treated by one of the various heat-disinfecting methods. When an infectious disease breaks out in a large institution such as a school, it may be necessary to keep the whole of the inmates in quarantine, i.e. the institute is placed under certain restrictions and the contacts are kept under supervision.

Treatment of the Patient in Hospital.—The commonest type of fever hospital provides separate wards, or even sections, for specific infectious diseases. Provision is also made for the careful isolation of rare or doubtful diseases. In certain areas there are established buildings and equipment for an epidemic of smallpox, but fortunately these are rarely in use. Smaller hospitals may have several infectious diseases under one roof, each patient being carefully screened off into a cubicle by a high partition, this cubicle being provided with facilities for toilet and other needs. Isolation is thus satisfactory, but the nurses have to be especially careful that they do not carry infection from one patient to another. If all the rules of disinfection be carried out to the letter, there need be no fear of this. The method of barrier nursing, in which a doubtful case of infectious disease is placed, say, in a measles ward, and the patient screened off or specially distinguished by a barrier at the foot of the bed, which warns all in the ward that he is not to be approached unless by officials, is sometimes adopted. Bed isolation is similar, except that no warning is given. Naturally the most scrupulous care is taken in such circumstances to prevent infection being taken to or from the patient. Each case must be regarded as if it were being isolated at home, and the nurse must be ever on the watch for pitfalls so that she makes sure she does not violate any of the laws of antisepsis. The only disadvantage of hospital treatment of this type is that not only is there a risk of the patient contracting another disease, but he may take home the germs of a disease to the other members of the family. On the whole, however, there is no doubt that hospital treatment for infectious diseases is ideal. It is certainly rather hard on the patient, since he is kept under very strict control and is not allowed to see visitors unless in very special circumstances; usually relatives are permitted to view the patients through large thick glass windows. In the event of any visitor having to enter the ward, facilities are provided for disinfection before and after the visit, while a sterile overall and headpiece must be put on before the ward is entered. Needless to say the nurse must put herself through a vigorous course of disinfection before she goes off duty.

Infectious Disease Breaking Out in a General Hospital.—The general nurse will be doing her duty as a citizen if she reports immediately any suspicious symptoms she may discover in a patient in an ordinary non-infectious ward of a hospital. Very often cases are admitted to medical, surgical and gynaecological wards, and it is found after a time that there is infectious disease; this causes great interference with the work of the ward for the reasons given above, therefore the slightest rash, sore throat, cough, spit, rise of temperature or other signs should be investigated at once. Until the diagnosis is established it may be necessary to adopt a temporary system of bed isolation, all the patient's belongings and utensils being kept apart from the others in the ward.

Treatment of the Patient at Home.—Isolation of the patient is not difficult in a good-class home, and often quite a satisfactory routine can be adopted by a resourceful nurse, who keeps in mind the principles enunciated above, as well as the essentials of disinfection. There are 2 things which help to maintain the isolated state of the patient, apart from the insistence on the rules of hygiene and the prohibition of visitors and communications to and from the outside world. A sheet, soaked in phenol or one of its allies, should be nailed up outside the sick room door. This, although possibly of no value as a means of defence against infection, may act as a psychological deterrent for the rest of the family against illicit entry into the infected room. Secondly, the nurse should have a large nail fixed up just within the doorway, and on this nail is hung her overall when she is not in the room. The first thing she does when she enters the room is to put on the overall and the last thing she does before she leaves it is to hang the overall up on the nail. In this way she makes sure that no infection is carried to or from the room. The perfect fever nurse isolates herself almost as much as her patient. It is much better if contact with the rest of the family be avoided. The ideal to aim at is the establishment of a completely self-contained unit in the sickroom, all instruments, utensils, feeding-cups, dressings and other necessities being dealt with in approved fashion and kept apart from the rest of the household. The nurse must be responsible for the maintenance of cleanliness and of hygienic perfection. It is a difficult job but well worth the trouble. If any article has to be sent from the room it must be submitted to one of the well known methods of disinfection already described.

Contacts.—So long as the patient is in an active state of fever, the rest of the family must be kept apart from others. School-children are joyfully released from the desk and adults are warned not to go to places of entertainment, but it is almost

impossible to prevent them from going to work, and this is one of the weak points in isolation. As soon as the Medical Officer of Health has pronounced the patient free of disease and the sanitary authorities have completed the disinfection, the restrictions may be taken off.

Final Disinfection.—The general routine is as follows. The convalescent patient, after a disinfectant bath, should put on clean, disinfected clothes which have not been near the sickroom. He can then go into another room prepared for him. Meanwhile the nurse should leave in the sickroom all clothing, books, toys, utensils, and other things which cannot be burned, should hang up her overall for the last time and should lock the door and leave the disinfectant curtain over it. She should have a bath and a change of clothing, leaving her nursing clothes to be disinfected in the sickroom.

The special sanitary officers sent from the health department will see to the disinfection of the room, which is usually fumigated for 8 hours. After the room is reopened, it should be subjected to a vigorous "spring cleaning," and, when possible, it is distempered and refurnished with curtains. The bedding and other fabrics may have been taken away by the sanitary men in order to be treated by steam; they are returned within 48 hours, and can be replaced in a room which has been cleansed in every corner, and subjected to the maximum amount of air.

In some cases, fumigation is now considered unnecessary, but the "spring clean" should never be omitted. Books, toys and any articles of small value should be destroyed. Bed linen should be soaked in phenol (1 in 40) for 6 hours before being sent to the laundry.

Death.—In the event of death from infectious disease the funeral should not be delayed. Isolation of the corpse is as important as isolation of the living subject.

CHAPTER 13

INFECTIOUS DISEASES—INDIVIDUAL TYPES

ENTERIC (TYPHOID) FEVER. INOCULATION. PARATYPHOID FEVER. SCARLET FEVER. PREVENTION OF SCARLET FEVER. SCHULTZ-CHARLTON TEST. MEASLES. SERUM TREATMENT. MUMPS. SMALLPOX. ALASTRIM. VACCINIA. VACCINATION. CHICKENPOX. WHOOPING COUGH. DIPHTHERIA. TESTS FOR SUSCEPTIBILITY. TETANUS. CEREBROSPINAL FEVER. ENCEPHALITIS LETHARGICA. POLIOMYELITIS. PUERPERAL SEPTICAEMIA. BRIEF NOTES ON OTHER INFECTIOUS DISEASES. ERYSIPELAS. TYPHUS FEVER. GERMAN MEASLES. INFLUENZA. ACTINOMYCOSIS. ANTHRAX.

In this chapter no attempt is made to deal exhaustively with infectious diseases. A summary of the most important points regarding each disease is given, so that the nurse who enters for the S.R.N. Certificate in General Nursing will have a fair working knowledge of this branch of medicine. There is a special certificate for fever nursing and those who wish to take the examination in this particular branch are recommended to consult the approved textbooks on the subject.

Enteric (Typhoid) Fever

Causes.—A short thick organism, the *Bacillus typhosus*, may be present in the blood, stools, urine, the spots of the rash, abdominal glands, spleen and gallbladder. The organisms have a tendency to lodge for long periods in the tissues of a former victim of enteric fever, and although they do not give rise to any symptoms in their host they may infect others. Enteric fever is therefore an example of a disease transmitted by carriers. Those chiefly affected are young adults of both sexes, and the commonest time of occurrence is the autumn. Owing to the wide distribution of the germ and as a result of its undoubted resistance the following sources of enteric fever are possible: milk, green vegetables (especially watercress), stale meat over which flies have crawled, bad water (or ice), oysters or mussels which have been raised on beds past which flow sewage-infected rivers, the excretions of a patient, soiled linen, infected soil and dust.

Symptoms and Signs.—The bacilli when swallowed choose as their particular ground the lymphoid Peyer's patches of the lower ileum and the catarrh spreads widely over the bowel; the glands participate in the infection. The disturbance of these areas is over by the end of the 2nd week in a normal case, but in a bad attack, ulceration, sloughing and even perforation may occur, so that the 3rd week may be a very critical one. If the patient recovers, healing should be in full swing by the end of the 4th week. The spleen and liver become enlarged but regain their normal size after the convalescent stage is well established.

Enteric fever begins very quietly. As a rule the patient may go about for a day or two, certainly out of sorts and shivery, troubled with headaches and off his food. When he is forced to go to bed it may be found that he has a temperature of 101° F., but this may drop to 99° F. next morning. After a day or two the record of temperature will show that the "ladder" or "staircase" type of fever has been instituted (see Vol. II, pp. 326–327). The pulse is much slower than we should expect with such a high temperature. As the symptoms become more intensified it is found that there is either constipation or its opposite—a typical diarrhoea with foetid "pea soup" stools. The enlarged liver and spleen cause the upper abdomen to be swollen and painful. At any time between the 7th and the 12th days there appears on the abdomen a crop of rose-coloured spots, like flattened knobs on the skin. They disappear and reappear and may be found on the chest, shoulders and back. A typical crop lasts for 4 days but sometimes there is not any rash. The tongue is very dirty at the edges, with a furry deposit, but the centre is red, dry and slightly glazed. In the event of a mild infection the patient is fairly ill, with all the signs of acute fever up to the end of the 2nd week after which he begins to improve and has an uneventful recovery. Very often, however, the toxaemia is so marked that the typhoid state (see Vol. II, p. 327) is a feature of the 3rd week, and the patient is dangerously ill. Apart from this there is the risk of perforation of one of the intestinal ulcers—an accident which often terminates fatally. The nurse must be on the lookout for all kinds of other complications, these being bleeding from the bowel, nose or any other mucous surface, acute bronchitis or pneumonia, abscess of bones, stiffness of the spine, inflammation of any part of the urinary tract, heart failure, distension of the abdomen and peritonitis. Naturally the symptoms of these accentuate the collapse and there is no doubt that at the end of the 3rd week and even apart from perforation or other serious mishap the patient with severe enteric fever is reduced to a mere shadow, with mental and physical impotence, poor circulation and maybe loss of bladder

and bowel control. The emaciation of typhoid fever is one of its characteristics.

All complications of a dangerous nature having been avoided, the patient begins to recover by the 4th week, and the temperature descends by the same route as it went up, so there is no sudden " turn." Indeed relapses must be looked for. A typhoid patient is not out of the wood until he is completely convalescent. The great feature of the disease is the reluctance it shows to disappear and cases may be drawn out for 6 to 7 weeks. It must be understood that it takes a long time to restore the heart, liver, lungs, intestines and all the other affected areas to their normal state.

We must always keep in mind the fact that many patients may walk about whilst suffering from typhoid fever (ambulatory type), and the condition may remain undiscovered until a severe complication sends the patient to bed. We also find atypical cases which either begin suddenly or end by crisis. A sudden collapse, with signs of abdominal distension occurring at a critical stage of typhoid fever, should warn us to look out for perforation. This demands immediate surgical treatment.

Diagnosis.—It is sometimes very difficult to distinguish enteric fever from ordinary enteritis associated with colic, results of dietetic errors, influenza or appendicitis. The blood may be examined by Widal's test (see Vol. II, pp. 224–225), the serum being drawn from the skin by a small capillary tube. The best time to make the test is during the 2nd week; even although a negative result is given, however, it does not mean that the condition is not enteric fever. There is also the diazo reaction of the urine, which may be noted after the 3rd day. Other tests may be made to find the actual bacillus in the stools or other media and Marris's test involves the giving of a hypodermic injection of atropine, which in true typhoid fever does not succeed in raising the pulse rate more than 12 beats per minute. Blood counts show leucopenia (reduction of white cells) during the first few days.

Treatment.—In the first place the nurse should remember to adopt all the precautions associated with infectious disease. Assuming that she fully appreciates the necessity for absolute conformity to every rule, there is no need to enumerate the special measures to be adopted. Particular emphasis must be made, however, on the virulence of the germs and on the fact that the excretions may be a fruitful source of infection. The nurse in an enteric case should keep well away from the larder and the kitchen. The sternest antiseptic discipline must be enforced. The special points about the nursing treatment proper are that the patient should not have the light full in his face and

that the utmost quiet and peace should prevail in the room. On no account should the patient make any undue physical effort; this is important in view of the fact that many of the heat-reducing methods of treatment already described in previous chapters may have to be adopted and the wise nurse will see that the bed is not too wide, but easily accessible from all sides. The patient is in a helpless, semi-collapsed state and likely to develop bedsores, hypostatic pneumonia, heart failure and many other complications that may be prevented by intelligent and imaginative nursing. Whether it be in the frequent toilet of the mouth, the occasional tepid sponging of the skin, the changing of position that brings so much comfort to the sufferer or any of the other procedures, the greatest care and gentlest handling should be the rule. We have already noted the beneficial effects of tepid baths and of other systems of making the patient react to water externally applied. The slightest exertion on the part of the patient during these treatments may cause collapse.

Feeding.—Enteric fever is a disease of the blood, but it is complicated by erosion of an important absorptive area of the intestinal canal; therefore the dieting is very important and full of difficulties. So long as there is danger of irritating the ulcerated area fluids should be the rule, but these fluids must be restricted. Milk must not be given *ad lib.* For the thirst there is nothing better than cold water. But we can ring the changes with Imperial Drink, lemonade, soda-water and so on; at least 4 pints of fluid should be given during 24 hours. The food value of milk must be carefully estimated and measured amounts given to which there may be added sugar of milk. Sometimes the patient does not like milk, and liquid gelatin (5 per cent), albumin water, beef tea, chicken tea, egg well beaten up, fruit or jellies may be substituted. Patients appreciate iced fluids and may be allowed ice cream. The restrictions on solids are not so great as formerly. Many doctors allow sieved food to be given from the start, and there is no reason why the patient should not have such diet during the 2nd week, provided all is going well. The great test is the stool; if the latter shows any undigested matter a more primitive diet must be reverted to. Barley water and lime water are helpful adjuncts to the diet. In the 2nd week of enteric fever, therefore, we might include in the menu custard, arrowroot, cornflour, creamed potatoes, lightly cooked eggs and the usual fluids. Vitamin preparations should be given also in order to combat the debilitating effects of the disease. Vitamins A, B, C and D are of equal importance. As the case proceeds the patient may become over-keen on his food, but he must be restrained as the possibility of relapse must never be forgotten. In the early stages 2-hourly or 3-hourly feeds may be the rule, but as we have pointed out already the nurse must be

prepared to accommodate her timetable to the conditions with which she is dealing.

Drugs.—Naturally any irritants of the bowel must be avoided. Intestinal antiseptics may be necessary, or even astringents, if the diarrhoea be excessive. A starch and opium enema is sometimes prescribed. Quinine and aspirin may be given when fever is high. Alcohol should be used only when necessary; it is a very much over-rated remedy. For the headache a cold compress is soothing, and when there is pain owing to abdominal distension a hot fomentation or turpentine stupe is advisable. Haemorrhage from the bowel means complete quietude and the best way to deal with the case is to give morphine by injection and to apply the ice bag to the right side of the abdomen. It is dangerous even to put the patient on a bed pan. The patient must be padded with cotton wool and napkins applied to the hips exactly as if he were an infant. In all cases of perforation the patient must be operated on at once.

In the cases which are characterized by obstinate constipation, a mild enema should be given, and with great care. It is sometimes advisable to give a urinary antiseptic by the mouth (urotropine).

The treatment may have to be continued for a long time. We can never be sure of typhoid until the stools and urine give negative reactions to bacterial tests and even then there is danger of constitutional weakness.

Inoculation.—Those in contact with enteric fever, or those who wish to prevent its occurrence, may protect themselves by having first a dose of Wright's vaccine consisting usually of 500 million organisms of *Bacillus typhosus* combined with 500 million of the paratyphoid group described below. In 10 days' time, twice the amount is given. There is a temporary malaise for a day after each injection, but there follows a period of great protectivity which may last for 2 years, and in any case it reduces the virulence of any possible typhoid attack. Undoubtedly the adoption of this system saved the British Army from enteric fever in both World Wars. Inoculation during the course of enteric fever has had very disappointing results. Certain sera may be given, but they have variable effect. The sulphonamides and penicillin have no effect on the typhoid bacillus.

Paratyphoid Fever.—Apart from some greater irregularity, some element of suddenness, and a distinctly less serious course, paratyphoid fever, which is due to the *paratyphoid bacillus A, B* or *C*, is much the same as enteric fever. It resembles enteric fever but has very few of the dangerous complications. It may be just as debilitating to the patient, however, and it requires as much care as does enteric fever.

Scarlet Fever

Causes.—Scarlet fever may attack anyone, but it concentrates chiefly on children between 2 and 12 years of age. It is due to infection by the haemolytic streptococcus. The disease often occurs in epidemics, but sporadic cases arise. The autumn and winter are the most usual periods for the epidemics which vary greatly in their severity or intensity. An attack as a rule confers immunity although recurrence of the disease is not uncommon in the same person. Sources of infection are discharges from the ear, nose and throat, clothing and fabrics and milk, which lends itself not only to infection from human beings but also spreads the organisms of a certain type of cow fever very much akin to scarlet fever. A type known as surgical scarlet fever commonly attacks persons suffering from burns, and is then due to infection of the raw area. Puerperal scarlet fever sometimes occurs soon after child-birth, and puerperal septicaemia may be contracted by contact with persons suffering from scarlet fever or acute tonsillitis of haemolytic streptococcal origin.

Symptoms.—After a variable incubation period (generally 1 to 4 days), the first signs of scarlet fever appear. The onset may be quite sudden, the patient turning pale, becoming very sick and seeking to go to bed. By night the temperature has begun to rise, there is intense headache and the throat is red and dry. The rash is to be expected on the following day. It is typical, forming a uniform salmon-pink blush all over the body and consisting of minute red dots each circumscribed by a pink area. The rash may be confined to the neck, chest and inside of the thighs, but it may be so slight that it is only shown as a series of red grooves in the bend of the elbows or in other parts at which the skin is in folds. Many cases of scarlet fever are missed in this way, and only when the desquamation begins is the true nature of the complaint revealed.

By the middle of the 1st week the temperature is as high as 103° F., and the tongue, which was furred at the beginning, is presenting the bright red surface with projecting papillae and known as the red strawberry tongue. There is high colour in the cheeks and this makes prominent a pale area round the mouth which is called circumoral pallor. There is a red, angry-looking surface on the pharyngeal walls and tonsils. In the absence of complications, the fever begins to decline on the 4th day and may be normal by the 5th day, although it may be a week until the temperature is steady. As soon as the temperature has fallen the skin begins to peel off and undergoes the classical desquamation, with shedding of hundreds of small scales. The peeling process may go on for several weeks. The hands and feet are usually the last to peel.

Types.—Not all cases of scarlet fever are simple. First there is a group, which may be very large, in which the symptoms are so slight that the only proof of scarlet fever is the desquamation. The patients are as infectious to others as those who have a severe attack. In septic scarlet fever there is marked engorgement of the throat, which becomes ulcerated; if perforations occur the condition is very grave. The breath is most offensive and the temperature may remain high for several weeks. Meanwhile all the other symptoms are accentuated. Malignant or toxic scarlatina is very dangerous. There are no marked outward symptoms, but the general condition is one of severe toxaemia, with high fever, delirium, vomiting and diarrhoea and it is evident that the patient has had a severe systemic shock. Death often occurs within 48 hours.

Complications.—The close association between acute rheumatism and scarlet fever is shown by the fact that often at the end of the first week certain joints become painful and swollen. The fever is moderate and there is no serious sweating, the skin remaining dry and rough as it always appears in scarlatina. Occasionally one or more of the joints become the seat of suppurative arthritis and blood poisoning may follow, frequently with fatal effect. The complications of endocarditis, pericarditis, bronchopneumonia and nephritis have already been referred to, and they must all be anticipated and prevented if possible. A common accompaniment of scarlet fever is inflammation of the middle ear, which may lead to perforation of the drum, chronic discharge or even the more serious mastoid abscess. Paralysis of the face and even meningitis may supervene. Certain of the glands of the neck swell during the 1st week and they may develop a suppurative condition later on. The urine may contain albumin for the first few days, but this complication passes off. It must not be confused with the type of inflammation of the kidney known as post-scarlatinal nephritis, a serious condition which comes on when the skin begins to desquamate and which may lead to uraemia and death. It is a feature of scarlet fever that there is marked irritation of the kidneys by the poisons which pass through.

Treatment.—We can treat scarlet fever by general and local methods. It is now customary to inject either a polyvalent antistreptococcic serum or a serum originating in true scarlet fever. Doses of from 10,000 to 20,000 units may be given. Sulphonamides are prescribed for the treatment of septic complications such as otitis media. It is claimed, however, that these complications can be avoided by adequate dosage of penicillin at the onset of the disease. The throat may be sprayed with various antiseptics. Opinions about desquamation vary considerably.

It is now generally believed that the scales do not transmit infection, and therefore isolation of the patient, which formerly lasted at least 6 weeks, may be reduced to 4 weeks or even less if the skin be treated with eucalyptus ointment twice daily from the 1st day. Other fertile sources of infection are the discharges from the nose, throat and ear. The period of infectivity is considerably reduced by the use of penicillin spray. Many doctors prefer to take no risks of "return" cases (i.e. persons who become infected by contact with a patient discharged as completely free from scarlatina), and insist on 6 weeks' isolation; for all practical purposes this is the best scheme. All scarlet fever patients are refreshed and benefited by daily sponging with a warm solution of Condy's Fluid, and a tepid bath is always welcome. The nurse must report the slightest signs of ear irritation and as a routine the urine should be daily examined for albumin. Lastly with regard to diet, although milk may be given in the fever period, the other protein fluids should be restricted as they cause irritation of the kidneys. But once the temperature is down, light diet may be given and gradually ordinary diet is allowed, provided the kidneys are unaffected.

When arthritis is discovered, the joints must be carefully wrapped in cotton wool and kept completely immobilized. The child should be nursed as for acute rheumatism because this complication has an exactly similar effect on the endocardium as has an acute rheumatic infection. The throat inflammation may become so severe as to necessitate a local anaesthetic paint. A cold compress externally will relieve the pain, while ice may be sucked for periods. If the pain of swallowing becomes too great resort may have to be made to tube feeding, preferably by the nasal route. Nephritis is treated as already described on pp. 288–293. Diphtheria may complicate scarlet fever in the later stages.

Prevention of Scarlet Fever.—The Dick test can be performed on all children, and by it we are enabled to differentiate persons into 2 groups—those who are susceptible to the germ and those who are not. By injecting a small amount of scarlatinal toxin into the skin, a reaction in positive human beings is obtained of the nature of a red wheal nearly an inch wide on the area tested. The reaction usually appears in 4 to 16 hours, and disappears after a day or two. All those who are positive should have preventive inoculation, so that they may become immunized to the organism and thus escape scarlet fever. Many local authorities are stressing this point and urging parents to render their children immune to the disease.

Schultz-Charlton Test.—If there is any doubt about the diagnosis of scarlet fever, a quick test may be carried out by injecting into the skin, when the rash is at its height, a minute

amount of dilute scarlatina antitoxin. Positive cases show, in about 8 to 24 hours, a blanched area which stands out clearly in the midst of the salmon-pink skin.

Measles

Measles or morbilli is a much more serious complaint than it was 40 years ago, and therefore it has changed places with scarlet fever; it has also become the more fatal disease.

Causes.—The causative organism is considered to be a virus impossible of observation by the ordinary microscope. It is a very infectious and powerful microbe nevertheless. Measles occurs in epidemics in spring and autumn and is well known for its rapid spread and its comprehensive application to young people below the age of 14. Owing to the sneezing, explosive coughing and easy transport by contacts and fomites, the germs saturate the atmosphere and they are poured into the air with every expiration. In addition to this there is undoubtedly an emanation of microbes from the skin of a seriously affected patient. An attack in childhood usually protects the child until he is over 20; measles, however, in adult life is not common. The infection may be spread whilst the patient is incubating the disease.

Symptoms and Signs.—If observed carefully, children always give warnings of measles long before even the signs of catarrh appear. They may be dull, heavy, irritable and generally difficult to deal with for about a week, but the most outstanding danger signal is a persistent pallor. At the end of this period the signs of an ordinary cold in the head appear, with sneezing, running at the nose and inflammation of the eyes. The temperature rises slightly and then the patient is put to bed. The eruption appears suddenly and has a dramatic effect on the patient in a few hours. He becomes covered with a rash which, beginning behind the ears, on the scalp and on the paler parts of the face, soon passes to the neck, body and limbs, so that on the 4th day the patient should be covered with a bright red blotchy patchwork of wheals, which have a peculiarly velvety appearance and are soft to the touch. They tend to form into crescent-shaped areas. In about 3 days the rash fades into a series of faint yellowish-brown marks, which also disappear in time. Coincident with the rash there is a rise of temperature to 102° F. or thereabout, this continuing until the rash fades on the 7th or 8th day of the disease. The picture of active measles cannot be forgotten; the whole skin seems to be swollen up, the eyes are puffy, watery and sore, photophobia (inability to stand strong light) is a feature and the dark red patches give a mottled effect to the whole aspect.

If we look inside the lips, or even on the gums, we may see a sign which is almost certain to indicate measles. Koplik's spots may be seen, 2 or 3 days before the rash appears, as greyish-blue spots surrounded by a ring of red.

There is always some diarrhoea and occasionally sickness for a day, and a certain amount of mild transient bronchitis is almost inevitable. But in the normal case, the condition clears up in a week, leaving a fine desquamation which is quickly shed. Unlike scarlet fever, measles quickly loses its infectious dangers; therefore patients are frequently released from all restrictions after 14 days.

Complications.—In certain cases, malignant measles may be demonstrated, in which the patient is dangerously collapsed and reduced to the typhoid state, with or without haemorrhages.

Even in the normal condition measles may be complicated by severe bronchitis, which ultimately may develop into broncho-pneumonia, a most dangerous complication in young children. The ordinary catarrh may be unduly protracted and may lead to laryngitis, tonsillitis and adenoids. In some cases the diarrhoea is serious, with green offensive stools, and there is always the danger of otitis media (inflammation of the middle ear) with discharge. The conjunctivitis in the eyes may pass on to more deeply seated inflammation. Nor must it be forgotten that the cervical glands may become swollen, the mouth ulcerated and the skin broken by gangrenous patches. Now and then hemiplegia occurs. Measles may also leave in its train the beginnings of phthisis, endocarditis and whooping cough.

Treatment.—Measles organisms hang about in the air; therefore the more fresh air there is in the sick room the better. So long as the patient is warm and comfortable, the ventilation should be as free as possible. It may be necessary to lower the blind for a day or two while the eyes are acutely inflamed, but the room should never have a funereal atmosphere and sometimes it is better to provide the child with a large double eye shade instead of darkening the room. The temperature of the sick room should be about 65° F., and therefore good fires may have to be maintained when the windows are wide open. In some cases the use of the vapour kettle is indicated for two reasons: 1. in order to create an antiseptic vapour; 2. for the relief of the generalized catarrh. During the period of the fever the child may require to have the lightest of coverings and this is permissible so long as the fever lasts, but in the period immediately following the drop of temperature (really the critical time in measles) there may be a need for an extra blanket. If there is any likelihood of heaping too much weight on the child, the provision of a bed cradle is advisable.

In the event of the rash being delayed, it is a well-known device among mothers of families to give the child a purge and to put him in a hot bath for about 10 minutes; in some cases ordinary sponging with hot water will produce the rash, and it has a very soothing effect on the patient. Needless to say, the nurse should be very careful of all discharges—nasal, oral, ocular and aural; they should be received into sterile squares of old lint or linen and burned immediately. It is a good plan to wash the skin daily with Condy's Fluid solution, while the eyes should be frequently bathed with boric acid solution, and the eyelids lubricated with olive oil, liquid paraffin or oculent of yellow oxide of mercury which is an excellent precaution in the prevention of reddened eyelids, often permanently disfiguring.

Whether bronchitis exists or not, the doctor usually prescribes an expectorant mixture. Each complication must be specially treated as it arises. The diet should be chiefly milk and beef tea in the acute stage, with a week of light diet to follow. The convalescent period is short provided there are no complications, and at the most 3 weeks' isolation is all that is necessary, assuming that the catarrhal signs have cleared up speedily.

Serum Treatment.—We are able to inoculate contacts with serum prepared from convalescent patients. So long as this serum is given early in the incubation period, it will abort attack, but the difficulty is to recognize the onset of the incubation period. Even if the serum (dosage: 2 c cm. for infants; 6 to 10 c.cm. for older children) is given just when the catarrhal signs appear it modifies the whole disease and further it does not limit the protectivity of the mild measles which follows its use.

Mumps

Causes.—This disease, particularly seen in the spring and autumn, is supposed to be due to some undiscovered virus which lives in the saliva: it is also known as epidemic parotitis. Males are more susceptible than females and the commonest period of attack is between the ages of 3 and 12. Infectivity is rather prolonged and contacts may have to be isolated for 4 weeks. Patients may spread the disease as long as 3 weeks after the glands have become swollen.

Symptoms and Signs.—Mumps usually begins with a general stiffness of the neck and a dull pain in the region of the temporomandibular joint. There may be some doubt as to the seat of the trouble, especially as the temperature may shoot up to 103° F. After a day or two in bed, during which he is pale, sick and generally miserable, the child begins to show a gradually spreading swelling of the parotid area, the space between the

angle of the lower jaw and the tip of the mastoid filling up and the tumour extending often to the submandibular and sublingual groups of glands. An abscess may be suspected, but that is put out of the question by palpation of the swelling, which has a certain elastic resistance and no fluctuation. In about 2 days' time—sometimes a little longer—the other side swells up similarly and we are presented with the classical and very dismal picture of mumps in full display. The temperature which has remained in the neighbourhood of 100° F. now falls, but the child is very miserable and his dry, sticky mouth, foetid breath, furred tongue and difficulty of swallowing fill his cup of woe. As a general rule the glands diminish rapidly after 7 to 10 days and the condition resolves without difficulty.

Complications.—The main complication is orchitis (inflammation of the testicle), which appearing at the beginning of the 2nd week may cause considerable pain and occasionally sterility. A similar but less marked involvement of the ovary or breast may occur in the female. Pancreatitis is not uncommon. The only other complication of note is transient facial paralysis.

Treatment.—Mumps must be treated with respect in view of the complications. Rest in bed is essential for 10 days. A general routine cleansing of the mouth and the application of hot fomentations or soothing lotions to the swellings must be carried out. It is unnecessary to tie the jaws up tightly with a sling or flannel bandage. The bowels should be kept free by salines. When necessary, feeding by tube may be instituted for a day or two. If orchitis should appear the testicles may be supported by a suspensory bandage.

Convalescent mumps serum is sometimes used with a view to limiting an outbreak. It has the disadvantage that jaundice occasionally develops some months after the injection.

Smallpox

Thanks to the discoveries of Jenner, the danger of smallpox, which formerly swept through countries leaving a trail of death behind it, has been reduced to the minimum and there is further happy reflection in that the virulence of the disease has been diminished considerably.

Causes.—Variola, as smallpox is technically termed, is due to some virus, as yet not conclusively determined. It is very infectious and no one unprotected has much chance of escape. The easy method of transmission accounts for the huge epidemics that may occur in non-vaccinated peoples. The disease may be passed on during the incubation period, by the very air of the sickroom, by clothing, by scabs and even from the dead body.

No matter how mild the disease may be in one person it may be demonstrated as the severest form in another.

Symptoms.—The disease starts actively with shivering, sickness, severe headache and pain in the back. Young children usually have a convulsion. The temperature rises to about 102° F., and there may be some doubt about the diagnosis since there is a preliminary rash on the chest or abdomen, resembling measles or scarlet fever. By the 3rd day, however, and often when the temperature has fallen, the rash has appeared and there can be no mistaking it. The face is markedly affected chiefly on the forehead, while there may be nodules on the scalp. Crops come out on the back of the wrists and then there is an invasion of less frequent distribution, beginning on the arms, spreading to the trunk and finally reaching the thighs. The eruption may be found on the palms of the hands and the soles of the feet. At the end of the 1st week the rash should be at its maximum. It is characterized by various stages, passing from a hard, firm papule to a dimpled, firm vesicle, which becomes a pustule and finally a dry, hard, black scab. The whôle process occupies about 15 to 20 days. The mucous membranes may be involved.

The fever, which is comparatively mild during the 4th to 6th days, begins to assert itself more and more as the pustular stage is established until on the 9th day it is clearly of septic type, with rigors and swinging temperature. This is known as secondary or suppurative fever. It is good to think that nurses will rarely have an opportunity of seeing this condition, because it is an example of an infection at its worst. The whole face may become oedematous and covered by a mass of ugly, festering scabs which obliterate every feature. If the patient does not sink into the typhoid state and die, he recovers slowly by lysis, the scabs falling off at the end of the 3rd week, and leaving behind the characteristic pits which cause a disfigurement for life.

Varieties.—1. *Discrete or Simple.*—In this case the pocks are widely separated from each other and show no tendency to run together.

2. *Modified* (*varioloid*) *Smallpox.*—A second attack of smallpox, or an attack which affects vaccinated persons, is characterized by great modification of virulence. The reactions are all very mild compared with the conditions described above but although the patient himself may escape serious injury, it does not mean that he cannot transmit the disease in full virulence to another not protected by vaccination, or otherwise.

3. *Confluent Smallpox.*—In this condition the vesicles run together and form great septic blisters on the face, hands and feet. The patient is very ill indeed, and has violent delirium; in 50 per

cent of cases death is to be expected on the 9th or 10th day. The earlier the rash appears and the more thickly set it is—particularly on the face—the more likely is the rash to coalesce and the disease to take the confluent form.

4. *Haemorrhagic.*—Generalized bleeding from the mucous membranes, from the vesicles and under the skin characterize haemorrhagic (malignant) smallpox. In this condition death is almost inevitable.

Complications.—There are many possible complications and after-effects, but modern treatment has banished some of the more serious affections. Nevertheless we must take particular care of the respiratory system, since inflammation of the larynx with ulcers, bronchitis and bronchopneumonia may interfere with progress. Inflammations of various parts of the eyes are a danger, while skin trouble often of a gangrenous nature is a common lesion. In cases of pyaemia the joints may become the seat of septic arthritis. Crops of boils may be troublesome. The permanent effects of smallpox, in addition to the pitting of the skin, are defective hearing, loss of hair and deficient eyesight. Apart from any complications, smallpox is a most dangerous disease in young unvaccinated children; it is an example of a complaint the seriousness of which can be measured by the number and concentration of vesicles. The farther apart the vesicles, the less is there danger of a fatal end.

Treatment.—The smell of smallpox is sufficient to influence us towards a regime of fresh air, but we must ensure that the air is warm. The difficulties of nursing are legion; indeed, in the delirious cases, the attendant, so far as males are concerned, should be a male nurse of perfect physique. There is no specific remedy which can be injected into the blood. All we can do is to alleviate the condition and to prevent spread of it as much as possible. The very mildest cases, and even patients who may only be suspected, should be at once removed to hospital and if the contacts themselves are not isolated in a reception house, they should, after preliminary vaccination, be very carefully supervised for 16 days. The patient's skin should be dealt with gently but efficiently. All the hair should be shaved off at places where it is thick and long and although it is impossible to ease the itching much, the pustules may be painted twice or three times daily with iodine and glycerine. The face and hands may have to be dressed with thick cotton wool and flannel bandages. When the pain in the head is very great an ice-cold compress is very much appreciated, especially over the eyes. These must also be protected by regular daily irrigation with boracic acid solution. In many cases sponging with tepid water is useful twice daily, but in very bad smallpox the continuous warm bath is

most beneficial as it softens the scabs, removes the waste-products and gets rid of the maximum amount of toxic elements.

It is clear that the nursing of smallpox means not only the routine treatment of a patient debilitated by the typhoid state, but there is the great obstacle in the way of recovery represented by a massive area of virulent skin poisoning which amounts to a collection of foci of evil-smelling local gangrene. Needless to say, every possible method of alleviation must be attempted. The sulphonamides and penicillin have no effect on the virus oı smallpox, but are useful in treating septic complications when they arise.

Apart from dealing with the various areas of the body by local applications, there is always the grave general condition of the patient to be considered. If vaccination be performed as soon as possible after the patient has been near an infected person the subsequent attack may be rendered much less severe, but vaccination attempted when the signs are obvious is quite useless. No nurse should ever approach an active case of smallpox unless she herself has been recently vaccinated.

Alastrim.—This is a form of smallpox which has taken the place of the more serious type and which occasionally breaks out in Great Britain. It may be regarded as the result of a very much weakened virus, and all the symptoms are mere shadows of the great substance of classical smallpox. Its name, variola minor, is sufficient description of its character. Very few deaths occur, and vaccinated persons escape if they have been protected within the previous 7 years. The vesicles rapidly pass on to the scab stage and a mild pitting may be left on the skin.

Vaccinia.—This is the representative of smallpox in the cow. If some of the lymph taken from a full vesicle of this disease is rubbed in by gentle scarification on the human skin, a vesicle arises within a week and passes through all the typical stages until after about 3 weeks the scab falls off and leaves the well-known vaccination mark. This, in effect, is the principle of the vaccination process described below. It was discovered by Jenner, at the end of the eighteenth century, that milkmaids who contracted vaccinia from the udder of the cow rarely developed smallpox, which was very prevalent at that time, and so he applied his knowledge to preventive inoculation.

Vaccination

All authorities are agreed that vaccinia is simply smallpox which by some means has been reduced in intensity by passing through the cow. If we use the organisms, therefore, as a means of causing a similar slight smallpox in the human being, we can

protect that human being for 7 years against smallpox. Of course we could use the lymph from a vaccination vesicle of one person and transfer it to another so as to be assured of pure human strains, but owing to the dangers of spreading disease, the accepted methods nowadays consist of using calf lymph.

How the Lymph is Made.—First of all calves are carefully selected, tested to make sure they do not react to tuberculin and then they spend a few days or weeks being prepared hygienically in a specially equipped cowshed, with every possible appliance likely to maintain asepsis. The abdomen is shaved and as many scarifications as possible made on the area; in due time the vesicles are ruptured and the lymph collected. Each batch is carefully registered and stored until the calf is killed and a post-mortem examination has proved the absence of tuberculosis. By a special method the lymph is then mixed with glycerine, tested at intervals for the presence of organisms other than the virus (which is very resistant) until the bacteriologist is satisfied that for all practical purposes the lymph is sterile, and then stored in a large ice-chamber. As it is required, the lymph is issued in batches in small sealed capillary tubes.

Modern Vaccination.—For many years it was customary to make 4 incisions (which need not even draw blood), each ⅛ inch long and occupying a diamond-shaped area over the insertion of the deltoid on the left arm. This led to certain virulent reactions in some cases and a few of the babies were affected 10 to 14 days later by a disease very like encephalitis, although it seemed that the persons most vulnerable were those who were first vaccinated between the ages of 3 and 16. A special committee was established and as a result of its recommendations the following is the routine established.

Vaccination should be done in the first instance when the child is between 2 and 6 months old. One small superficial incision should be made and the lymph should be lightly applied. The skin should be prepared with alcohol and ether and should be well rubbed to induce a blush before the vaccination is done. The child should then be held in his mother's arms for about 10 minutes, care being taken that nothing touches the bead of lymph. Then a pad of lint with plaster should be applied, reinforced by a 2-inch open-wove bandage. On the 8th day the child should be examined, and if the scab has "taken" the fact should be notified, the certificate signed by the doctor, and another dressing applied. If mothers are carefully instructed to take care of the dressing and to make sure that the child does not scratch the scab, there is no fear of any complications, but carelessness will always show a proportion of septic scabs, ulcers and even cases of severe constitutional reaction with convulsions.

To make certain of immunity to smallpox, the child should be revaccinated at the age of 7 and again at the age of 14. When an epidemic is threatening it is advisable that all who have not been protected within the previous 7 years should be revaccinated. It is the safe and sure way to prevention of smallpox.

The new method of vaccination puts out of the question many of the old objections.; at one time unless the parent objected, by signing a certificate of conscientious objection, to the vaccination of his child, vaccination was compulsory. Recent legislation has made it entirely voluntary, and this is a reflection on the growing opinion among medical men and women that preventive hygienic methods are satisfactory, always provided that in the threat of an epidemic, ample lymph will be available for vaccination purposes.

The local reaction to ordinary vaccination is a miniature and limited form of smallpox, shown by hard pimples surrounded by redness on the 3rd day, vesiculation on the 6th day and indented bleb on the 8th day. The usual pustule appears on the 11th day, and the scab is shed 3 weeks after, leaving a small pit, which becomes a white scar permanently displayed at the site of vaccination. In ordinary cases there is slight malaise on the 3rd day, but a dose of castor oil seems to work the necessary oracle in the majority of cases and although the child may have a swollen arm for a week, the reaction settles down very quickly. There is nothing to fear from properly conducted vaccination, but nurses who take up child welfare work would do well to insist on extraordinary protection of the scar; the dressing must be made fool-proof.

Chickenpox

Chickenpox, or varicella, is said to mimic smallpox but there is little or no real resemblance. It is a children's disease and very infectious.

Causes.—Now and then epidemics rapidly sweep the country, but the causative organism remains undiscovered. Infection is conveyed by the usual methods, but unlike smallpox, chickenpox cannot be transmitted by inoculation from the vesicle. Immunity follows the attack. The virus of chickenpox is probably identical with that causing shingles, since the two diseases commonly occur simultaneously in different persons occupying the same house.

Symptoms and Signs.—Irritability and general malaise lead to a slight fever, with dirty tongue, constipation and lack of appetite. Often the first sign is the first crop of vesicles, which constitute the rash described below. These vesicles tend to occur in crops which erupt during the initial 3 or 4 days.

The Rash.—Generally the trunk is first to suffer, the face and limbs remaining comparatively free. The spots may be far apart. The difference between chickenpox and smallpox is that in chickenpox there is a vesicle within 24 hours, which is not indented, which is free of surrounding blush and which is a dry scab by the end of a week at the latest. Further, the fever in chickenpox coincides with the outbreak of the rash; this is not so in smallpox. Very rarely do we find ulcers or pitting, these being due to excessive scratching. The skin shows the rash at all stages, owing to the daily occurrence of new crops. Now and then vesicles appear inside the mouth or on the tongue.

Treatment.—Apart from general nursing for about a week, the bowels being kept free by salines, the only treatment required is careful powdering of the skin. The patient may be in bed for a week or so, and an occasional warm boracic bath or sponging with Condy's Fluid is indicated when the scabs are troublesome. One or two usually give difficulty. Isolation is necessary until every scab has fallen off.

Whooping Cough

Causes.—Adults rarely suffer, the disease chiefly affecting children between the ages of 2 and 12. When infants are affected they are seriously ill as a rule. The causative organism is the *Haemophilus pertussis* (bacillus of Bordet and Gengou), although a virus theory is also held by some. The bacilli are chiefly disseminated by the explosive coughing which causes a fine spray containing the organisms; infection is spread chiefly during the first week. Spring and autumn epidemics, associated with measles, are the rule. It must never be forgotten that whooping cough may be one of the most dangerous of the infectious diseases. The toxaemia is very marked.

Symptoms and Signs.—The disease may well be regarded as a spasmodic type of bronchitis resulting from some nerve poisoning. Three stages are generally described.

1. *Invasion.*—This lasts for about a week, beginning with a sudden temperature of 101° F., and showing all the signs of a moderate bronchitis.

2. *Spasm.*—After about a week or 10 days of general discomfort and irritability with increasing cough, the stage of whooping begins. This is a period which may extend to 6 weeks, but generally it lasts for 3 weeks. It is characterized by the occurrences of spasms, described below, which seize the patient with a frequency varying according to the gravity of the attack.

The typical spasm, which may occur as often as 60 times a day, but usually once every 2 hours, begins with a few short attempts at coughing; the child seems to be suddenly seized by

a vice-like grip in the trachea and makes a desperate cumulative effort to get the expired air released. He goes on in this " hacking " manner until he may have had a dozen coughs, all in rapid succession; then as if at last at his wits' ends to cope with the absence of new air, he gives a great " whoop " which is really the sudden end of the spasm and the rushing in of inspired air to the empty lungs. One phase may follow another, but usually after 3 or 4 whoops, the child, now exhausted, perspiring and bluish-red in the face, brings up from the stomach about a tablespoonful of frothy fluid, mixed with creamy food material and sometimes blood. He then sinks back utterly exhausted on his bed. In some cases the whoop is absent, but that need not mean that the diagnosis of whooping cough is impossible. In very bad cases, with frequent paroxysms and alarming spasms, we may find that bleeding from the nose, eyes and mouth may occur, and now and then, especially in very small children, convulsions are set up. Occasionally collapse of the lung and asphyxia ending in death are experienced. Between the attacks the child may appear comparatively well but there is always a degree of bronchitis. Nurses should remember that the slightest excitement or worry or movement may set up a spasm, and they should be very careful of these

3. *Decline.*—The attacks may gradually become less and less frequent until 1 or 2 a day may be reported. It is sometimes 2 months before there is complete freedom. Whooping cough is one of the most tenacious diseases known. If a child is seized with the disease in January he may be expected to be under its spell until April.

Complications.—We have already mentioned the possibility of convulsions, but far more serious is the danger of bronchitis, bronchopneumonia of most fatal type and even tuberculosis. A prolonged attack may result in emphysema with chest deformity. The degree of the condition depends upon the toxaemia. A baby of 1 year, with 60 spasms a day, is in a most dangerous state, and likely to die. Wasting due to vomiting and anorexia is also a severe and common complication; this can be minimized when the child is fed immediately after vomiting (only small feeds being used); all fluids should contain glucose.

Treatment.—Strict isolation should be the rule, the contacts being quarantined for 3 weeks. The period of isolation depends upon the cough, but is never less than 6 weeks, although there is little probability of infection after 4 weeks. Nursing of the child in bed for the first week or two may be difficult, owing to the violence of the spasms and in these the nurse is often powerless to help the struggling child who becomes desperate in his agony. The doctor probably prescribes a sedative such as

belladonna, but chloral, ephedrine, ether and bromides are also given. In bad cases the steam kettle, containing creosote or friars' balsam, may have to be used. The giving of vaccines has generally proved to be useless. Some doctors advocate the inhalation of a few cubic centimetres of carbon dioxide during the spasm. The sickroom should always be well aired.

Finally a word must be said about convalescence. There is no need to keep the patient in bed once the fever is over and the spasms are declining. Indeed experience has proved that children do very well after the 3rd week or so, if they are taken out for a quiet walk in the morning and in the afternoon. Naturally the nurse must accompany them and see that they keep to themselves, and also that no wild running or excess of excitement is permitted. But there is no doubt that beneficial effects are produced by early outings of this type—the more fresh air the better. Otherwise we must bear in mind that we are dealing with a lingering poison, which leaves behind it much debility and general flabbiness of muscle. A good long holiday at the seaside, with tonics, cod-liver oil or halibut-liver oil and malt and a diet containing ample vitamins, will soon restore the patient to normal health.

Diphtheria

Of all infectious diseases, diphtheria is perhaps the most dreaded, as it acts very quickly and soon produces a condition of acute toxaemia complicated by local changes of a critical nature in the throat. It has a high mortality unless treated by modern methods.

Causes.—The organism responsible is a small bacillus, the Klebs-Löffler bacillus (*Corynebacterium diphtheriae*,) which remains on the surface of the throat and together with other germs causes local ulceration, but it also sends its toxins into the blood supply and thus poisons important organs such as the heart and the nerves. It should be understood that diphtheria may settle anywhere, even on the skin, but it is rarely effective unless it happens to become established on mucous membranes. It is easily spread by coughing of the patient, and often infection is conveyed to nurses and doctors in this way, either when they are attempting to obtain a swab of the virulent pharyngeal mucus or during the operation of tracheotomy. The organism must be looked upon as something very hard to kill and therefore ubiquitous. This accounts for the fact that although epidemics may occur diphtheria is always active to a certain degree in all populous centres. The disease incidence is further complicated by the variable reaction of individuals. For instance a diphtheria convalescent may retain the germs in his throat and

continue to spread them to his neighbours although he himself is perfectly well. Much more serious is the person who seems to have established diplomatic relations with the bacillus. The latter embeds itself in the throat of its host and causes not the slightest disability, although it may be the source of many cases of active diphtheria in others. Such carriers of diphtheria are a great stumbling-block to the subjugation of the disease. Milk may also be a source of infection, but the old idea of "bad drains" being at the root of the trouble is not accepted nowadays. It must also be remembered that diphtheria is ready to seize upon the opportunity presented by a throat already debilitated by measles or scarlet fever. Recurrences are possible. It must be clear to the nurse that diphtheria is a disease demanding all her energies, mental and physical.

Symptoms and Signs.—Various types of diphtheria may be found, depending upon the extent of the membrane. The first general symptoms are those of indefinite illness, the child becoming easily tired and complaining of difficulty in swallowing, dry throat and pain at the sides of the neck; these may become so severe that the temperature rises to 100° or 101° F., then vomiting occurs and the child goes to bed. Even at this stage the cervical glands in the upper part of the neck may be felt as hard nodules. If the throat is then examined, it may show apparently innocent white patches on both tonsils; these are frequently mistaken for ordinary evidences of tonsillitis, but the latter condition in children should always be regarded as diphtheritic and treated with respect. Within 24 hours the patches on the throat may have spread to the pharynx, posterior nares and soft palate, and on further examination the whole of the pharyngeal area may appear to be covered by a dirty, yellowish-grey skin like wash-leather—an ominous sign. By the end of another day, the temperature, which rarely goes above 102° F., may have dropped to subnormal levels and may remain there for a time. This is typical of diphtheria. But if the temperature has dropped, it is no indication of the end of the poisoning; it is rather the reverse. The membrane rapidly thickens, spreads and more firmly attaches itself to the underlying tissues, so that when an attempt is made to remove it there is bleeding. Meanwhile the child is obviously very ill, rather blue in the face, very tired (almost to the point of collapse), with a quick but faint pulse.

Types of Diphtheria.—We usually differentiate one or two types of diphtheria according to the degree of spread. There is the simple faucial diphtheria, which remains where it started and limits the local condition. But the membrane usually attempts to travel and it may involve the nasopharynx, causing a very dangerous nasal discharge, stoppage of the posterior nares, a

typical "nasal accent" in the voice, and sometimes epistaxis. Or it may spread down the pharyngo-tympanic tube to the middle ear, and it has been known to reach the bronchi. Spread to the larynx is the most important condition, however. If laryngeal diphtheria is extensive it may form a membrane passing across the air outlet and lead to asphyxia unless the operation of tracheotomy is performed immediately. Very often diphtheria begins as a laryngeal infection and it is then known as membranous croup. We find the expected symptoms of stridor, with great pulmonary embarrassment, peculiar high-pitched metallic cough and cyanosis all very alarming. As in faucial diphtheria, the membrane may spread upwards or downwards. In any case this form of diphtheria is dangerous from every point of view, whether it be that of the intense general toxaemia, of the possibility of septic pneumonia or of the acute obstruction requiring surgical relief.

Course.—As a rule the disease is restricted to the fauces, and thanks to antitoxin, we see less and less of the grievous complications nowadays. The membrane may strip off in a few days, leaving a grey-white surface which soon resolves, but if it is very thick it may not be so easy of removal. Owing to the weakness of the muscles signs of myasthenia may prevent the patient from doing much to help himself, but this may be a blessing in disguise. If the membrane rapidly extends and the general toxaemia increases, the patient may die from excessive absorption of poison. The terminal signs are extreme weakness and sometimes vomiting. Albuminuria is common.

The course really depends upon the number of complications (see below) and upon the gravity of the infection. In the benign type of diphtheria, the signs and symptoms may be so slight that the diphtheria is not discovered. The child is off-colour for 3 or 4 days and the throat clears up in 48 hours; since a doctor is rarely called in there is no opportunity of swabbing the throat for examination purposes. Nevertheless this is the most difficult aspect of diphtheria from the public health point of view, as the convalescent may be a fertile distributor of virulent diphtheria organisms. In the ordinary type the patient is over the worst by the 14th day, or alternatively succumbs to the disease. There is a malignant or haemorrhagic form which is grave from the start and which is characterized by subcutaneous haemorrhages and bleeding from mucous membranes as a result of the haemolytic activities of the toxins in the blood vessels, which are also weakened themselves. Death occurs often in the first 48 hours, the patient being in a completely collapsed state.

Complications.—We must not forget that diphtheria may spread to other parts of the body and may affect the conjunctiva

of the eyes, the vulva or the open parts of wounds. Inflammation of the middle ear, nephritis and blood poisoning by mixed infection of septic type may also be found. The kidneys may become the seat of nephritis. But the two most dangerous complications are failure of the heart and post-diphtheritic paralysis. The former is the result of direct poisoning of the cardiac muscle by the toxins, and it may have effect many weeks after the acute stages have passed. The latter may also influence the heart by paralysing the vagi nerves, and together the muscle weakness and the nerve affection produce tachycardia, dyspnoea, pain and irregular action. The toxins give rise to the well-known peripheral neuritis and cause first the local paralysis of the palate or of the nasal areas, then affect many of the muscles of the eye, causing squint and difficulty in focusing the eye. As the paralysis spreads to the trunk muscles it may cause impairment of all limb movements, stoppage of breathing and lastly the impairment of the cardiac nerves referred to above.

The 3rd week of diphtheria may therefore be regarded as the critical one and the greatest care must be taken to anticipate these complications as detailed below under the heading of Treatment. Cases have been known in which the patient has died of heart failure several months after recovering from the immediate effects of diphtheria. The poisons seem to take a very long time to become neutralized.

Treatment.—The first part of the treatment consists of diagnostic tests. This is a simple matter of lightly passing a prepared swab over the affected area and having the exudate examined by the bacteriologist, who may be expected to give his opinion within 24 hours at the most. Many doctors take no risks, however, and since every minute is precious they give antitoxin as soon as the trouble is discovered. This antidote to the toxin of diphtheria is prepared from the blood of a horse which has been subjected for a period to carefully increased doses of the toxin of diphtheria. At a certain time the blood is drawn off, and the serum is used as antitoxin. The latter is put up in phials each containing so many standard units, the strength being defined by regulation. There is no doubt that giving of antitoxic serum has revolutionized diphtheria and has made its occurrence much less of a trial to doctor and nurse than formerly. One of the essentials is early inoculation. To begin with, 4,000 to 12,000 units should be given, but if the case is a severe one, it may be necessary to give a further 6,000 to 12,000 12 hours later; in very dangerous cases a 3rd massive doze of a strength compatible with the virulence of the organisms at work may be called for. Many doctors give one large dose of 20,000 to 50,000 units, using the venous route, especially if they see the case for the first time when it is in the well developed condition. The guiding

light for the antitoxic treatment is the state of the membrane. Once it has separated, the immediate danger may be said to have passed. So far as drugs are concerned, penicillin is sometimes used in conjunction with antitoxic serum.

The nursing of diphtheria is not difficult if the nurse understands that the one essential is complete rest. Apart from the discomforts of the variable membrane, the patient is not unduly distressed after the first week, but from what has been stated above, it is obvious that the heart must be given the minimum of work. Confinement to bed varies according to the degree of the infection, but even in the mildest cases the period of 3 weeks after the separation of the membrane is insisted upon. In many hospitals the progress of each patient is determined by the number of pillows. In the 1st week, no pillow is provided; in the 2nd 1 pillow is allowed; in the 3rd 2; and lastly a 3rd pillow is added in the 4th week. By this method the heart is gradually "acclimatized" to its ordinary work. It is better to keep a diphtheria patient a few weeks longer in bed than to take risks, however keen he may be to make progress. The pulse is a guide to the condition, but even although it may be quite satisfactory to the observer, it does not mean that the heart is able to stand up to any stress. As in typhoid fever there must be a strict regime of "do-nothing" on the patient's part. It is often very irksome, but he must be trained to depend upon the nurse for feeding, lifting, turning, sanitary attention, washing and indeed every act that involves the slightest muscular stress until he is allowed up.

The food should be fluid for the first 3 or 4 days, and nasal feeding may be necessary when the throat is very sore or when there is palatal paralysis. Most patients manage to take their nourishment well out of the ordinary feeding cup, but a good plan is to fix a 6-inch rubber tube to the feeding cup spout and to allow the patient to suck up the food by this means. In mild cases easily digested solids may be given from the beginning, but ordinary diet should not be provided until the membrane is removed. Glucose is a valuable adjunct to the diet and can be given in large amounts. It has a beneficial effect on the heart muscle.

The local condition may be dealt with by spraying or gentle swabbing of the throat with 3 per cent phenol, 0·5 per cent formalin or by local douching with sodium chloride, sodium biborate, sodium bicarbonate and thymol dissolved in hot water. If a child be upset by throat swabbing, the latter is better omitted; the cardiac condition must not be endangered. Indeed, with the modern early use of antitoxin as a routine, and with the careful and regular testing of the throat for bacteria, treatment of diphtheria may be said to be almost in the hands of the bacteriologist.

The days of severe membranous overgrowth are nearly past; the operation of tracheotomy, a method of making an incision into the trachea and inserting a tube, is not nearly so common as it is used to be. Thanks to a vigorous general campaign of education and warning, the incidence of the disease is diminishing. The mortality rate is also very much lowered.

Any sign of paralysis should be reported. Very often the development of a squint of one or both eyes or the presence of an unusual nasal twang in the voice is enough to warn the nurse that special treatment is necessary. When the limbs are involved, a long course of gentle massage, faradic current, strychnine medication and other stimulating methods is indicated. Respiratory paralysis may be combated by nursing the patient in an "iron lung."

Isolation is usually insisted upon for at least 3 weeks after all membranes and discharges have disappeared. The modern system of testing the throat by swabbing stipulates that not until 2 negative swabs, taken successively and with 3 days between, are provided, can the patient be said to be free of infection.

Tests for Susceptibility.—The importance of the Schick test for diphtheria has become nationally recognized. The susceptibility to diphtheria is very marked in children under 5, and it gradually wears off with age. But many are in the position of being prone to an attack should they be infected. The situation is rendered more difficult owing to the number of carriers, who are potential spraying agents and who are very difficult to neutralize since they are not affected by prophylactic inoculation. The need of having a test done in all children above the age of 5 is obvious. By it we can find out either 1. that a person is immune or 2. that he is susceptible. In the latter case we have at our disposal a method which, in the words of the Ministry of Health, is "efficacious and satisfactory." Intradermal punctures made on the forearm show in about 3 days a positive or negative reaction to diphtheria. In the positive cases inoculation can be carried out by using the mild "toxin-antitoxin," "alum-precipitated toxoid" or "formol-toxoid" mixture, and although the immunity may take a few months to develop completely, it protects the individual for at least 3 years. It is likely that this form of immunization will become as important as that of smallpox, but meanwhile we must realise that the present period is one of transition and that statistics are constantly changing. The number of persons known to be immune amounts to about $\frac{1}{8}$ of the population, and the incidence of and death rate from the disease are steadily declining.

Tetanus

Causes.—The organism is a small bacillus shaped like a drumstick, the *Bacillus tetani*. It is frequently found in the manure of horses and cattle, and is therefore most likely to be transmitted to the human being by dirt in gardens and other cultivated areas. It is very commonly found in conditions of modern warfare, so much so that every soldier who is wounded is given a dose of serum of antitetanic properties at the main dressing station. Popularly known as lockjaw, tetanus may be introduced into the human tissues by small cuts, scratches or other apparently insignificant wounds and has been known to follow a confinement. The bacillus behaves very like the diphtheria organism, remaining at the wound and sending out virulent toxins which poison the rest of the tissues.

Symptoms and Signs.—A little over a week after the injury has been sustained, complications such as stiffness of the neck and lower jaw appear. Gradually the masseter muscle goes into spasm and the corners of the mouth and the eyebrows are raised giving to the patient a somewhat comic grin, known as the risus sardonicus. It is tragedy and not comedy with which we have to deal, however. Very soon the stiffness spreads to the muscles of the back and the patient may be twisted into all kinds of positions, the commonest of which is one in which the back is arched and the back of the head and the tips of the heels only are in contact with the bed (opisthotonos). The muscles soon become constantly fixed, there is board-like hardness and a pain which is worse than the severest cramp. Sometimes the temperature is extraordinarily high. Death is common within a week (60 per cent of cases). A mild and rapidly relieved attack may result in those who have had serum.

Treatment.—In addition to the darkening of the room, the quietude and the giving of sedative drugs such as chloral hydrate, chloroform or avertin by the rectum, administration of tetanus antitoxin is advocated. This should be injected subcutaneously and intramuscularly, a certain amount being given every day for a week. Rectal feeding may be necessary when the jaw is too difficult to move; nasal feeding often sets up spasms and should be very carefully carried out. Nursing procedures are carried out while the patient is under the influence of the anaesthetic.

Cerebrospinal Fever

This special form of meningitis is known also as spotted fever and occurs in epidemic form. A type of very similar character affects infants and is known as posterior basic meningitis.

Causes.—The epidemics are usually confined to a restricted area e.g. army barracks, institutions and similar places. Young male adults are commonly affected, but children of both sexes may suffer also. The organism is the meningococcus, a small organism which usually lives in the nose and may thus be spread by sneezing or by direct contact. Carriers may harbour the meningococcus for a week or two without apparently suffering any harm, while there are a few chronic carriers, a class akin to the diphtheria carriers already discussed. In severe cases the organism can be found in the cerebrospinal fluid. The best conditions for spread of the disease seem to be those which are found in overcrowded places.For example if it is damp, cold and generally disagreeable weather, we may find that soldiers may crowd round a barrack-room fire or children round the fire of the kitchen. Even loud talking may disseminate the germs.

Symptoms.—Many of the symptoms are like those of meningitis already described (pp. 314–315) but spotted fever is sudden in onset, and headache, vomiting and serious pains, passing from the back of the head to the spine, cause great distress. The course of cerebrospinal fever, like that of so many diseases, has been amazingly modified by chemotherapy. Formerly head retraction, accompanied by delirium and later coma, ushered in the end. Convulsions were common in babies. The patient became worn out and emaciated by constantly recurring spasms like those of tetanus which were initiated by the slightest sound or movement. On the 3rd day a variable rash, sometimes like herpes (shingles) but more frequently purple and widespread, could be noticed. A temporary improvement followed but with a quick rise in temperature, the patient relapsed into an almost moribund "typhoid state." Death occasionally occurred within a few hours but more usually within a week. Permanent damage was nearly always left in those who survived the illness.

The complications included septic arthritis, deafness, blindness, pericarditis, pneumonia and pleurisy.and mental changes.

Treatment.—The whole outlook of these cases has been changed by the treatment by sulphonamides. Sulphathiazole is most commonly used and this in serious cases is given intravenously. Penicillin is probably equally efficacious. In all cases there must be adequate intake of fluid (up to 5 or 6 pints daily) to combat dehydration, and in cases in which sulphonamides are used, to lessen the risk of crystallization of the drug in the urinary tubules. Potassium citrate is also prescribed to render the urine alkaline for the same reason. Hexamine in big doses up to 60 grains 3 times a day may be given combined with potassium citrate (double dose); this prevents irritation of the kidneys. The hexamine is said to be excreted into the

cerebrospinal fluid as formaldehyde. The nursing is the same as for other types of meningitis (see p. 305). It is usually very exacting but the nurse now knows that there is a real hope of complete recovery without the disabling after-effects which formerly made the care of these patients so sad a task.

Encephalitis Lethargica

This malady, also known as encephalitis epidemica, the epidemic form of encephalitis already mentioned in Chapter 7, is popularly known as sleepy sickness, and must be carefully distinguished from sleeping sickness, which is a tropical disease. Although this disease was first recognized only in 1917, its chronic form is already established, according to an authority, as the commonest chronic organic nervous disease, therefore its importance is obvious. There was a spate of acute cases up to the year 1924, but since then the incidence has dropped considerably and we are more concerned with the sequels to the primary attack.

Causes.—Cases may occur singly or in epidemics. Personal contact does not seem to have much influence in the spread. So far the causative organism has not been discovered but the disease is thought to be due to a virus of which there are probably several types. Young males are attacked more than others. Encephalitis lethargica has probably some association with influenza, especially as the infection is thought to be conveyed from the mucous membrane of the nose. Although the base of the brain is usually the chief site of the inflammation the disease may affect any part of the nervous system.

Symptoms.—To begin with, observers stipulated 3 cardinal signs, viz. rise of temperature, paralysis of the eyes and a state of lethargy, the last giving the characteristic stamp to the disease. It has since been found that there are numerous manifestations, however, ranging from the mildest form of fever to the most marked positive signs of encephalitis. The great drawback to the elucidation of the disease is that the chronic form may supervene on an almost unnoticed acute attack, and after many years. And since the chronic form is very serious and most difficult to manage, encephalitis lethargica must be regarded as one of the most serious problems of modern neurology.

The acute condition may come on rapidly or slowly. In the former case there may be fever, headache, vomiting, hiccough and well marked constipation. These gradually give place to a state of lethargy in which every movement is slow, the mental process is dulled and the face assumes a mask like that of Parkinson's Disease. Very often these symptoms occur without

preliminary fever and this makes the diagnosis more difficult. The patient may have lucid intervals in which he is quite clear in his mind, but he drops off again into a semi-stupor. On the other hand the very opposite may be found—excitability, delirium and even mania. One of the great danger signals is paralysis of the eyes, which seem to lose all control; all kinds of squints and fixed positions are found.

In the cases which progress to a chronic state and in those which break out from apparently no cause whatever, the outstanding sign is the state of marked parkinsonism, in which the patient shows various interesting abnormalities—mask-like face, increased salivation, drawling speech, a "silly" and frequently childish type of mentality and slow shuffling gait. Children may lose all the evidence of early moral training and may suddenly demonstrate many forms of hitherto unthought-of delinquency; it is an entire change of character and very interesting from a medicolegal point of view. We are still finding out many new facts about encephalitis lethargica, and it is certain that in a short time the disease will be presented as a widely extending and greatly varying disease from which many deaths occur and about which we cannot predict the degree of ultimate damage.

Treatment.—This is still speculative. Probably the most successful results have been obtained by the use of stramonium pills and more recently by administration of benzedrine The nursing of these cases demands all the skill and energy of the attendant and a great amount of patience. Insomnia of a certain type is common, the patient frequently turning night into day, and vice versa, so that special arrangements may have to be made for this. It should never be forgotten that the victims of encephalitis lethargica may suddenly become dangerous lunatics.

Poliomyelitis

This disease is well known as infantile paralysis, but this is somewhat of a misnomer, since adults may be victims. At one time the disease was referred to as acute anterior poliomyelitis but the plain and more accurate term, poliomyelitis, is now accepted by all. It may occur in epidemic form, but may break out here and there as a single isolated case. The effects are indicative of some interference with the cells and fibres of the lower motor neurons.

Causes.—The organism responsible is a very small one, and of spherical type, probably a streptococcus. The usual channel of infection is the nose, the organisms apparently reaching the spinal cord by way of the lymphatic vessels. Infants of both sexes are

most commonly affected. When epidemics are prevalent, however, anybody may be fatally afflicted with the disease particularly children in boarding-schools. The cells of the anterior horn are found to be the site of an inflammatory process. Ultimately degeneration of the efferent fibre takes place.

Symptoms and Signs.—In the sporadic cases there is generally great surprise at the dramatic change which may be wrought in a single night. A previously robust and healthy child after a day of mild snuffling and slight irritability may be found by his mother in a state of paralysis, generally affecting one limb. The picture is typical. We are presented with an apparently well nourished and soundly developed arm or leg, which for some mysterious reason may have become flaccid and useless in a single night. Generally, however, there is some warning, in the form of 3 or 4 days of sickness, slight fever and pains in the limbs, and then follows the characteristic collapse. Woe to the doctor who has glibly assured the mother that the case is one of "teething trouble" or of mild stomach derangement. It is very hard to have to confess that serious paralysis has occurred, and that permanent disability is inevitable. Many medical men have been blamed for carelessness or lack of appreciation of the true condition, when of course they are utterly helpless to prevent the course of the disease. To begin with all the limbs may be affected, or only one, or even only a group of muscles, but there is always a certain amount of improvement, the final paralysis depending upon the degree of degeneration of the affected fibres. While the sporadic type is rarely fatal, there is a death rate of nearly 10 per cent in the epidemic type. In some cases there is a short febrile illness, with intense headache, but no manifestations of paralysis.

Permanent Effects.—Following on either type, but most frequently after the infantile, single-case variety, there are permanent and crippling paralyses of one or more limbs, which are retarded in growth to a certain extent, owing to poor blood supply of the bones and to the degeneration of the muscles. Deformities and contractures require various appliances; generally the arm becomes semiflexed, while the hand is thin and the fingers pressed together. Although the patient makes every effort to lengthen his leg by adopting the position of talipes equinus in the foot, and by curving his spine towards the affected side, there is generally permanent shortening, for which a special boot may be used with advantage.

Treatment of the Acute Condition.—The patient should be completely isolated and full barrier precautions taken. If any of the muscles of respiration appear to be affected, a mechanical respirator ("iron lung") should be used, either the Drinker

or the Bragg-Paul pulsator; the latter has the advantage of leaving the limbs free for treatment by passive movements and heat. It should be realized, however, that nursing is difficult under these conditions and as life in the respirator may be prolonged for several years, it is questionable whether it is worth living.

Hot packs may be applied 4-hourly during the day and twice nightly to relieve pain and improve the circulation; passive movements should be made at all joints once daily in full range provided no distress is caused. Voluntary movements should be encouraged from the start if possible without causing pain or distress or prolonged stretching of weakened muscles. Overtiring should always be avoided. Support is important and should be effective without the rigid immobilization which has been practised in some cases in the past in a well-meant endeavour to prevent contractions. The patient should be maintained in an optimum position of rest, so that there is no stretching of affected muscles. When the extensors and the flexors of a limb or the trunk are affected (two opposing groups of muscles incapacitated) the limb or trunk should be placed in the mid position. It is well to take a long view with these patients, and with the utmost kindness and in no haste insist on the correct position with due regard to comfort. It is no kindness to a patient to make him comfortable only, with no regard to recovery of power or prevention of contractions, although everything should be done to relieve pain. The legs should be placed in some degree of abduction in order to rest them and in inward rotation since the force of gravity tends to pull the legs into a position of outward rotation; the feet should be supported in dorsiflexion. When the spinal muscles are affected, a bed board under a firm mattress should be used and care taken that the patient lies straight so that a scoliosis or a lord-

FIG. 66.—TREATMENT OF POLIOMYELITIS.
Fixation of arms in abduction to rest weak deltoid, flexors of elbows, and spinators of forearms without discomfort of splinting.
(With acknowledgments to "Illustrated" and to the Hospital for Sick Children, Great Ormond Street, London, W.C.1.)

osis does not develop owing to the pull of unaffected muscles. Abduction of the arms may be achieved and rest given to the deltoid by tying the arms to the top of the bed by means of a clove hitch round the wrists. Support for the feet may be given by placing a board at the foot of the bed; the patient's slippers can be fixed to the board permanently and his feet can be easily removed for movements and attention to pressure points and other treatment.

Rest plasters, or light splints of Cramer wire or duralium, may be made if desired and constructed to suit individual cases.

Treatment of the Subacute Condition.—At this stage it will be desirable to test the muscles electrically to estimate the extent and degree of residual paralysis. Some authorities advise electrical treatment at this point and others are opposed to its use until later. Its advocates maintain that it helps to maintain the tone of the muscle and prevents fibrosis and helps the circulation. It is very difficult to assess accurately the value of any treatment in this disease; some patients recover with very little treatment

FIG. 67.—TREATMENT OF POLIOMYELITIS.
Electrical testing of the muscle with the Ritchie Sneath stimulator.
(*With acknowledgments to "Illustrated" and to the Hospital for Sick Children, Great Ormond Street, London, W.C.1.*)

of any kind and others do not recover in spite of every care. Nevertheless we have only to observe the cases of gross contractures and deformity to become stimulated to maximum effort.

When electrical treatment is ordered, faradism is given to those muscles which respond to it and interrupted galvanism to those in which no faradic response is elicited; sometimes combined faradism and galvanism is more comfortable. Hot packs will not be necessary as pain subsides, but contrast baths may be

given and splints must be removed every 4 hours and movements performed. The splints may be removed for lengthening periods, due care being taken to avoid overstretching of affected musculature. Weightless exercises, with gravity eliminated, may be commenced by means of a bar and support fixed to the

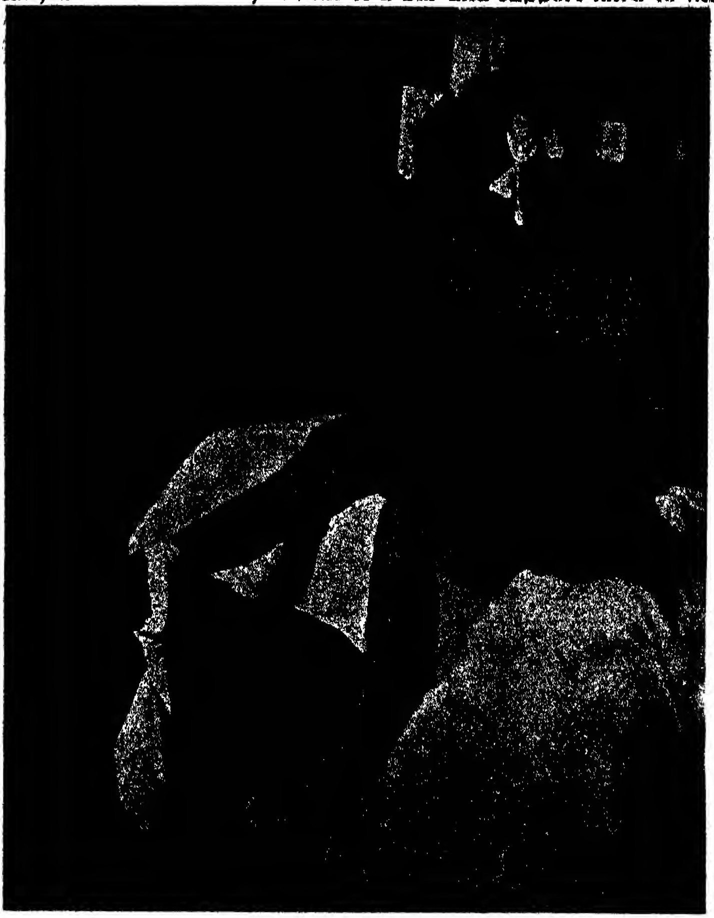


FIG. 68.—TREATMENT OF POLIOMYELITIS.
Exercise of the quadriceps muscle, using weight resistance at the ankle.
(With acknowledgments to "Illustrated" and to the Hospital for Sick Children, Great Ormond Street, London, W.C.1.)

bed and the use of slings. Exercises in a deep bath (Hubbard tank) or in a pool are invaluable; the movement is easier and the patient is encouraged to further efforts. The cooperation of the patient is a most important factor. Light massage should be

begun as soon as the tenderness of the muscles has disappeared, so as to improve the circulation and prevent the accumulation of waste-products. A back support may be required in certain cases. This consists of a perfectly fitting leather cast, provided with ample strapping for fixation. When the abdominal muscles are affected a canvas corset fitting across the front or a block leather support may be worn. Sometimes neck supports are required.

Treatment in the Chronic Condition.—The convalescent stage may be very prolonged or rapid recovery may occur. The major part of the recovery generally occurs within a few months of onset but further marked improvement may be noticed over a period of 2 years and in some cases there has been slow gradual improvement over many years.

As time passes the massage can be made more stimulating, but most important are the exercises to strengthen muscles and to prevent deformities. The Guthrie Smith suspension frame may now be used for re-education exercises. By this means the control of muscle work can be very accurate and any muscle group isolated and exercised with assistance, with the elimination of gravity or with the resistance of springs or of weights and pulleys as the condition requires. When the final stage of recovery has been reached and no further improvement with physiotherapy can be hoped for, surgical measures may be necessary e.g. tendon transplantation or arthrodesis of a joint, but the majority of patients do recover without surgical operation. Where there is shortening of one limb due to lack of growth of the affected one, surgical boots will be necessary, the boots being built up so that when the patient is standing with feet together the pelvis is level. This is necessary to avoid development of scoliosis. In a chronic case in which the support of a caliper is necessary, bending calipers, which can be locked or unlocked to facilitate movement, e.g. in getting on and off buses, should be provided. There is a great need for some inventive brain to devise some means of building up a shoe adequately without undue weight, as it is hard to ask weak muscles to lift a heavy boot, yet the hips must be kept level or spinal deformity will result.

The Kenny Treatment.—Lastly a few words must be said about the treatment adopted and advised by Sister Kenny; this has caused much controversy in Great Britain and America, in both of which countries the theories of Miss Kenny have been challenged. Briefly there are 3 Kenny concepts: 1. early muscular spasm causes anaemia and subsequent contractures; 2. there is mental alienation, a psychological blocking of impulses; 3. abnormal motor patterns in the muscles cause incoordination. Treatment is based on these concepts, and the

only commentary to be made is that Miss Kenny's results speak for themselves.

Puerperal Septicaemia

By septicaemia we mean the introduction into the blood of bacteria which rapidly multiply and thus flood the whole of the arterial and venous systems with toxic products. The subject is fully discussed in Vol. IV, Section XII. The only form of septicaemia requiring to be studied at the moment is puerperal septicaemia, an infectious and dangerous disease known also as puerperal fever, childbed fever or puerperal sepsis.

Before the development of chemotherapy this disease accounted for the greater number of deaths following childbirth. The subject is again discussed fully in Section XII as a part of obstetrics.

Causes.—Generally puerperal sepsis is the result of the slightest tear or injury done to the generative organs during childbirth. The openings allow the entrance of streptococci or staphylococci, and these rapidly multiply, giving rise to the symptoms and signs mentioned below. The most common invading organism is the haemolytic streptococcus.

Contributory causes may be found in unclean clothing, dressings, instruments, midwives or doctors, but it is amazing to see how the disease may occur after the most punctilious care and the most exhaustive precautions. A talkative midwife with a septic throat may spread thousands of harmful germs over the vaginal area as she performs the after-toilet of the birth. One great known fact, however, is that the disease may be transported from one patient to another, and thus the midwife must at all times be most careful in her asepsis. The mother may infect herself if she has septic teeth or tonsils. This is known as an autogenous infection. Very strict regulations control the conduct of a case of puerperal septicaemia and nurses in charge must never approach another maternity case until they are declared free of danger of spreading the disease. See also Vol. IV, Section XII.

Symptoms and Signs.—While this disease is properly a branch of midwifery, it must be understood fully by the general nurse, since it may follow gynaecological operations or treatment. Various forms are known, and collectively they constitute the condition of puerperal sepsis, but puerperal septicaemia, the condition in which there are bacteria in the blood, is the most serious, and it accounts for most of the fatal cases. Sapraemia is a condition of poisoning of the tissues due to absorption of toxins from germs which exist on lacerated surfaces or retained products of conception and other open areas, but which do not enter the blood. General infection may give rise to pyaemia,

when the blood vessels of the pelvic region form small multiple abscesses. Pelvic cellulitis and pelvic peritonitis, diffuse inflammation due to microbes, may cause a spread of the trouble to the whole of the pelvic region.

The most serious type begins a few days after the child is born. Rigors, accompanied by high temperature, with rapid pulse, severe vomiting, diarrhoea and a critical state of weakness make the condition very grave and the mortality mentioned above is not surprising. The other states are more easily managed and are like such surgical conditions elsewhere.

Treatment.—Any case of puerperal pyrexia of 100·4° F. persisting for 24 hours and whatever its cause may be, is reported by the midwife to the doctor in charge and to the Local Authority.

Local treatment of septicaemia may consist of the introduction into the uterus through a fine catheter of 20 c.cm. of warm sterile glycerine. This promotes a profuse discharge of lochia and helps to localize infection.

General treatment with the appropriate variety of sulphonamide drug or by penicillin is extremely effective provided it is instituted in time and with thoroughness. These drugs have been the means of almost eradicating one of the chief terrors of childbirth, and are discussed in Section XII.

Brief Notes on Other Infectious Diseases

Erysipelas.—In this condition the skin is invaded by an infectious streptococcus and in addition to the great local redness, swelling and heat, there are marked constitutional symptoms of fever, vomiting, shivering and headache, while the patient may become somewhat " heady." The usual channel of infection is a small cut or abrasion from which the solid eruptive area spreads quickly with definite raised margin. Generally the patient is confined to bed for a week, after which the temperature falls and the condition quickly clears up. There is a particular type of person associated with erysipelas; it often attacks chronic alcoholics who are not too clean in their habits. On the other hand it may be found in those who are very clean but whose skin is especially susceptible.

The nursing is simple if it be remembered that the germs are very prolific and swarm over the fabric and furniture of the room. The face is usually affected but local treatment is now not necessary, as the disease usually responds quite quickly to general sulphonamide or penicillin therapy. The nurse should be very careful of her hands, wearing rubber gloves and paying particular attention to antisepsis. She may contract the disease through the most minute abrasion of the skin. The great danger

of erysipelas in obstetrics need hardly be mentioned; formerly it was a menace to many hospitals. The urine should be tested daily, as albuminuria is common.

Typhus Fever.—At one time typhus fever was prevalent in Great Britain but now it is rarely seen. The organism is as yet undetermined; it is associated with dirt and general low type of living, and used to be called "jail-fever" or "ship-fever." There is no doubt that the human being is infected in the majority of cases by the body louse. The disease was rife in the German concentration camps The characteristics of typhus fever are its sudden onset, its quickly produced weakness, its high temperature and rash on the 5th day and its unmistakable odour of mice. Usually after a stormy fortnight of delirium, constipation, rigors, fur-coated tongue and various other signs leading up to the typhoid state, there is a sudden crisis usually accompanied by diarrhoea, and the patient rapidly mends. In many cases, however, death ends the critical stage. All kinds of complications must be expected—gangrene, severe bedsores, pulmonary congestion, abscesses and neuritis. The rash, which first appears on the 5th day as a dull red mottling on the abdomen, later spreads to the chest and hands, then to other parts of the body. Here and there are also found small papules which remain after the disease is over. The treatment should always be carried out in an infectious diseases hospital. The more fresh air the better for the patient. Owing to the serious complications, the attendants on the patient should be well accustomed to typhus fever and to general nursing. The most vigorous cleansing and disinfection of the dwelling house, clothes and contacts must be done, while the patient himself must be most scrupulously clean. There can be no infection where there are no lice. The nursing is much the same as in typhoid fever; the patient should be kept perfectly quiet and in a darkened room. Ice compresses applied to the head and tepid sponging of the body are beneficial.

German Measles.—Known also as rubella, this disease is very like ordinary measles and at one time, owing to the character of the rash, it was thought to be a mixture of scarlet fever and measles. It is usually a very mild complaint but very infectious. Beginning with malaise, headache, shivering and a dry throat, the disease may clear up in a few days. The rash, which consists of small red spots slightly larger than those of scarlet fever and not so much elevated as those of measles, is usually apparent at the end of the 1st day of illness, but both rash and fever have usually gone by the 3rd day. The one prominent feature of German measles is the enlargement of the occipital glands. It is a very mild affection and rarely is complicated because there

are no lung catarrhal accompaniments. Treatment is that of an ordinary cold in the head; in most cases the patients make no complaint, but regard the attack as a somewhat interesting experience. In order to limit the spread, however, contacts should be isolated for 3 weeks, and the patient cannot be released from quarantine until 10 days after the first day of the rash.

Influenza.—Influenza is a most maligned disease. True influenza is distinct and serious and should not be confused with any other disease. Nevertheless the term has come to be applied to almost every indefinite minor chill, or pyrexia, or severe coryza or even atypical pneumonia. People talk glibly about " 'flu " as if it were a refuse heap for all the odd maladies of civilization.

A typical attack of influenza requires as much care and attention as typhoid fever. Epidemics sweep countries, because the causative bacillus, which probably works in company with other virulent organisms, is rapidly transferred from one person to another and immunity lasts only for a certain period.

After a very short incubation period (2 to 5 days) there is sudden headache, followed soon afterwards by widespread dragging pains in the back, legs and joints. The patient feels utterly worn out. There may be a rigor after he goes to bed, but usually the temperature remains at about 102° F. The nose, throat and mouth are dry, the voice is often hoarse and there are present all the signs of a very severe cold. When the fever has persisted for 48 hours, however, it is observed that something more serious is afoot. The patient may be confined to bed for 10 days, becoming very weak and suffering from short relapses. Generally the disease takes one of the 3 following courses.

1. *Respiratory Influenza.*—This is a simple extension of the organisms to the lung regions, and they set up severe bronchitis, pneumonia and other congestive states, causing a well-known cyanosis referred to usually as "purple 'flu." There may be severe haemoptysis. Death commonly results from the very toxic pneumonia.

2. *Gastro-intestinal Influenza.*—There may be a spread of the disease down the gullet and this gives rise to gastritis, with vomiting, loss of appetite, gnawing pain, diarrhoea and even jaundice.

3. *Nervous Influenza.*—Pains in the heart may be troublesome in early convalescence and the patient suffers from sleeplessness and depression; sometimes there are symptoms which suggest encephalitis lethargica.

Too little attention is usually paid to the serious sequelae of influenza, which has far-reaching effects. The depression may be very grave, and suicide has often followed a serious attack.

The lung and heart weaknesses take a long time to clear up. Old people suffer worst of all. In certain serious epidemics, the death rate is very high, but as a rule recovery in normal outbreaks is good.

Rest in a warm bed is one of the first essentials of treatment. The usual nursing is necessary, particular attention being paid to the bowels and to the throat, which should be gargled frequently. Various drugs are used more or less empirically—quinine, aspirin, phenacetin. One of the chief features of the treatment is to prevent the patient from getting up too soon. Bravado in influenza usually results in a relapse and serious complications. In the convalescent stage it should be recognized that the patient is very much handicapped by general debility of marked degree, the result of the intense toxaemia. A holiday at the seaside or among the hills is nearly always necessary before the patient can be said to be fit. Nothing strenuous should be done during this change, as the heart and muscles are always weak. Breathlessness is a danger signal. The best way to improve the physique is by baths, massage and gradually increased exercises.

Actinomycosis.—Actinomycosis is a fungus infection. It occurs in persons whose work brings them in contact with horses and cattle. It most commonly attacks the mouth and it is thought that the habit of chewing grass and straw may be responsible for at least some of the cases. It may invade the thorax and abdomen, attacking any of the organs and also bones and blood vessels. The infection extrudes itself through the skin, giving rise to deep suppurating sinuses. The course of the disease is extremely chronic, and if untreated, invariably fatal.

Treatment.—For many years deep x-ray therapy and administration of potassium iodide in large doses were the main forms of treatment and they are still used with much benefit although they seldom really cure the disease. Gold therapy and autogenous vaccines have also been tried. Recently there have been claims of cure by sulphonamide and penicillin therapy. The sinuses are usually incised and scraped.

Anthrax.—Anthrax is a disease of cattle which can be transmitted to man by contact with infected hides, by the use of unsterilized shaving brushes or by inhaling dust from bales of sheep's wool. The causative organism is a spore-bearing bacillus (see Vol. II, Section IV). The skin lesions are large pustules with black centres from which the disease derives its name (anthrax = coal). It is also known as malignant pustule. The most common sites of infection are the face, neck and shoulders. There are acute general symptoms and the mortality

is high. The respiratory infection is known as woolsorters' disease and this is an extremely malignant and fatal form.

Treatment.—Results of treatment by sulphonamides and penicillin are so far inconclusive, although some claims of cure have been made. Arsenic given by injection and anti-anthrax serum are the most efficient known forms of treatment.

CHAPTER 14

VENEREAL DISEASES

SYPHILIS. CAUSES. STAGES. CONGENITAL SYPHILIS. TREATMENT. TESTS FOR SYPHILIS. CONCLUSIONS. GONORRHOEA. OPHTHALMIA NEONATORUM

VENEREAL diseases are diseases which affect primarily the sexual organs of both men and women and they are spread by direct contact. Their antiquity is undoubted and much of the world's history is bound up in them. In this chapter the two most important diseases—syphilis and gonorrhoea—are dealt with only. They are in the true sense of the word, dreadful diseases; they are easily spread and have wide ramifications in almost every part of the body.

Syphilis

It is impossible to deal fully with the great subject of syphilis, a disease which is apparently being slowly conquered, and the nurse must be content with the main features of a most comprehensive malady. Many of the diseases dealt with already in this work are the direct result of syphilitic infection.

Causes.—The cause is an organism known as the *Spirochaeta pallida*, *Spironema pallidum*, or *Treponema pallidum*, according to the fancy of the person dealing with it. It is a very small, fragile, spiral organism, but its entrance to the body is more easily effected than its exit. Two great varieties are known: 1. acquired syphilis, arising out of sexual intercourse or as a result of accidental transference, either from an infected patient to a cut or open sore on the hands or other parts of the nurse or attendant, or from contaminated articles such as tumblers, cups, scissors and various other utensils and instruments; 2. congenital syphilis, the inherited form of syphilis present in the blood of the newly-born child.

Stages.—If syphilis be allowed to run its full course, it may provide us with 3 well-defined stages, all of which must nowadays be considered as infectious.

1. *Primary Stage.*—After an incubation period of 2 to 6 weeks a small nodule, very like an early smallpox papule, appears

usually on some part of the external genital organs of either sex; if the spirochaetes have settled elsewhere (in the eye, on the lips or even on the fingers) they will cause a similar swelling which may not be easily recognized. Ultimately there develops a typical indurated sore which is known as the hard chancre. This may or may not form a shallow ulcer. In either case it contains active spirochaetes and it causes a limited but very hard swelling in the inguinal glands on both sides. After a week or two the chancre clears up, leaving behind a small scar which in the female especially may be difficult to discover.

2. *Secondary Stage.*—A period of from about 6 weeks to 3 months may elapse after the appearance of the primary sore, then the secondary symptoms are demonstrated. The spirochaete apparently masses his forces for a few weeks in the blood before deciding to make a second attack. The chancre is merely the base camp or landing stage. The secondary symptoms are ushered in by shivering, slight fever and sickness of no great moment, then follows the appearance of a slight rose-coloured rash on the abdomen and the occurrence of a very sore, congested throat.

The first rash may be replaced by many other forms of rash. Syphilis is a great mimic. All kinds of eruptions may be found, occurring symmetrically on the body, coppery-red and frequently the size and shape of a threepenny piece or somewhat less. Pustules, scaly patches, small pimples, slightly elevated plaques, all may be syphilitic evidences and they may all be found at one time. It is often very difficult to distinguish such skin conditions from eczema, psoriasis, seborrhoea and various other common skin diseases. Usually there is neither itch nor pain. In many cases the defect has to be brought to the patient's notice. Now and then ulcers form but they rightfully belong to the third stage. In addition to the above it is common to find in secondary syphilis white patches on the mucous membrane of the mouth (leukoplakia), heaped up warty nodules in the region of the sexual organs, but often round the anus (condylomata), ulcers on the tonsils, inflammation of the iris and temporary loss of hair. There is usually anaemia, sleeplessness, pains in the bones (especially those of the head) and general debility. Despite all these the patient may not consult a doctor, and all may clear up.

3. *Tertiary Stage.*—Volumes have been written on the manifestations of this stage, which may be demonstrated many years after the secondary stage has passed and when indeed the disease is often quite forgotten. It can thus be appreciated how complicated the tardy evidences of such a serious complaint may make a patient's life. Rarely the secondary stage passes into the tertiary stage, the anaemia increasing, the debility growing

greater and the ulceration becoming a marked collection of punched-out circles of raw flesh, which leave their brand behind them to mark the sufferer for the rest of his life.

The constitutional reactions of syphilis in the tertiary stage are general debility, severe anaemia and lack of resistance. The local or regional reactions run into hundreds, affecting almost every tissue and organ of the body. A certain type of soft, cheese-like tumour called a gumma may form in the bones or in other tissues. The following is a categorical list of the features of tertiary syphilis:

- Ulcers;
- Swellings of bones;
- Aneurysm;
- Gumma of almost any tissue;
- Chronic inflammation of the arteries;
- Amyloid disease (waxy degeneration);
- Locomotor ataxia;
- General paralysis of the insane;
- Tendency in females to abort;
- Thrombosis.

Congenital Syphilis.—Babies born with syphilitic blood may not show evidences immediately, except when they are markedly affected by pemphigus, a condition of massive and poisonous boils. Usually, it takes about 3 months for the disease to make its presence obvious, and then it is demonstrated by obstruction and "snuffles" in the nose, the result of bony degeneration. This may clear up, but it leaves an obviously depressed bridge which to those who know is a positive sign for the rest of the child's life. Cracks may also develop at the sides of the mouth, these later forming white streaky scars. The secondary condylomata and leukoplakia may also be found. The nails show degenerative changes (onychia). There may be also thickening of the skull and painful swellings of the bones. The spleen and liver may be so enlarged that they cause "pot-belly," and this, combined with the wizened face and wrinkled skin, gives the child the appearance of a senile person.

If the child should overcome such defects he may have trouble with his teeth. When the permanent set erupts, it is noted that the upper central incisors are peg-like and definitely notched on their lower border (Hutchinson's teeth). Later on the eyes may be affected by iritis or a peculiar "steamy" condition of the cornea known as interstitial keratitis. Early tertiary stages may be seen in young adults, who suffer from swellings of bones and joints, gummatous tumours and certain forms of juvenile tabes.

Treatment.—It is well known that certain drugs are in the majority of cases specific for syphilis if they are given at the right time.

In the primary stage, local treatment is indicated as well as general treatment and here let it be said that nurses should all remember that the fluid from primary or secondary sores may be

very infectious, so that every possible antiseptic precaution should be taken. There is a popular and widespread slur on syphilis, no matter how innocently it may be contracted, and nurses should be aware of its easy spread so that they can adopt every measure to avoid the risks of becoming victimized in more ways than one. Spirochaetes may be discovered in the chancre, in which case mercury may be given internally in the form of pills or powders, the treatment being continued for several years under supervision. Local disinfectants can be applied to the chancre. This treatment carries the patient through the period of the secondary stage, and may be varied by injections of calomel cream or by inunction of mercury and the general condition must be improved by tonics. In the tertiary stage the approved method of treatment is a combination of mercury and potassium iodide, provided that the arsenical compounds are not required.

Arsenical and Bismuth Preparations.— A great amount of research has been done during the last 40 years regarding the nature of syphilis and there is now established a form of injection treatment in which both arsenical derivatives and bismuth salts are used. Of the former there is now a considerable list of very reliable preparations such as salvarsan and kharsivan but they must be given with great care, either intramuscularly or intravenously (never subcutaneously), and with a certain amount of concomitant mercury treatment. One method is to give a course of 6 to 8 intravenous injections at 10-day intervals and to provide mercury in the form of injections or inunctions. Sometimes a second course of treatment is necessary after 6 weeks, but in most cases the treatment is determined by the negativity of the Wassermann reaction mentioned below. It must be made clear to the nurse that syphilis is a disease of world-wide importance and incidence and therefore there are many different ideas regarding arsenical administration. The policy of controlling the disease is that of making periodic tests for a year or more. In the absence of positive results for 3 years after all treatment has ceased, we may conclude that a cure has been effected. When bismuth is used instead of salvarsan, it is generally given twice a week by the intramuscular route for about 6 to 7 weeks. In all cases of syphilis it is better to over-treat than under-treat, provided the patient is not adversely affected by the injections. The routine of treatment naturally varies according to the surgeon's principles. With the recent introduction of penicillin for the treatment of this disease, the above regime will probably be considerably modified. It is too early in the history of penicillin to estimate long-term results, and well-tried methods which have had success are still being used.

Tests for Syphilis.—The blood may be tested for syphilis by a method which is based on immunity reactions. It may be

said that the Wassermann reaction, as this test is called, is a sure sign of syphilis in most suspected cases, but if it is negative it does not mean that the patient is free of syphilis. Despite all the mysteries associated with it, it is without doubt an almost indispensable controlling index in active disease. Another test—the Lutein test—consists of using an extract of spirochaetes in much the same way as the Dick or Schick tests. Skin reactions are found within 2 to 10 days after local injection. A third reaction—the Sigma reaction—is somewhat like the Wassermann test and is claimed to be more simple but quite as reliable. There is a fourth test, the Kahn test.

In all cases of syphilitic infection, it is necessary to examine all members of the family, and to trace all contacts, but this is not an easy task.

Conclusions.—It is obvious that only the main and elementary facts have been stated above. Syphilis is such a complex and far-reaching disease that it is baffling to all but the expert. National legislation has effected certain controls in order to limit spread and have treatment applied at the earliest moment. One of the greatest obstacles to cure is the secrecy and shame associated with the disease. Nurses meet syphilis every day in their career and probably it will be unrecognized. This is not to be wondered at, since the manifestations are so numerous. All the special facilities available nowadays for treatment and supervision should be taken full advantage of, and the nurse's duty is clearly that of controlling the disease until expert advice is obtained.

One last point must be stressed. Because a lesion is present in the genito-urinary system, it does not mean that syphilis or any other venereal disease is present. Indeed the nurse will encounter, especially in gynaecology, far more non-venereal cases than venereal cases.

Gonorrhoea

Like syphilis, gonorrhoea is a venereal disease, but the consequences are usually less serious. The cause is a kidney-shaped coccus, which may be seen in pairs within the leucocytes of the discharge. Transmission of the disease may be effected by contact, as in sexual intercourse. In the male the organisms settle on the mucous membrane of the urethra and cause inflammation and discharge; in the female the lining of the vagina becomes inflamed and similarly septic. Many females suffer from gonorrhoea without being aware of it, and thus it may be transferred to children and others by the fingers. Little girls are quite easily infected with gonorrhoea, and being highly infectious the disease can be transmitted to other children

especially in a ward or school dormitory. A common form of gonorrhoea in babies is ophthalmia neonatorum, a severe type of inflammation of the eyes contracted in the process of birth. Midwives must always take precautions to prevent this by dropping silver preparations into the eyes of the new-born child. Acute gonorrhoea in the adult has a tendency to spread to the neighbouring tissues, thus setting up acute abscesses in the glands of the groin (bubo), epididymitis, inflammations of the bladder, uterus, ovaries, uterine tubes and kidneys. The general systemic complications include serious endocarditis and a well-marked arthritis of one joint, usually the knee. The possibility of septicaemia of gonococcal type must not be forgotten. Treatment by vaccines of stock and autogenous types is successful. Diuretics and plenty of fluids, and a light, bland non-stimulating diet all help to get rid of the gonococci in the primary focus. Irrigation with various disinfectants and the application of antiseptic vaginal tampons was formerly the rule. The gonococcus is, however, very sensitive to both sulphonamides and penicillin and there is hope that with these efficient measures at our disposal, the disease may, in course of time, be completely eradicated. Whether or no the knowledge of easy cure will remove a deterrent from the licentious is a social question. In very acute cases and in all the serious complications, rest is essential. Nurses should take great care that they do not spread the disease to themselves or to others; the possibility of infection from towels, diapers, water closets and so on must be borne in mind. All vaginal discharges should be treated with suspicion.

Ophthalmia Neonatorum.—So many cases of blindness have resulted from this disease that regulations are very strict about its prevention and treatment. It is a notifiable disease. If the eyes are swabbed with boracic lotion as soon as possible after the child is born, and if careful toilet of the whole body is carried out without delay, the germs may be removed, and the child is safe, since the eyes are usually closed when the child is passing through the vagina. Doctors as a rule, or midwives under doctors' orders, drop in a few minims of a solution of silver nitrate or Argyrol (10 per cent). This prevents any further damage, but nurses should not forget that it is possible to infect the baby afterwards if the mother is suffering from a gonorrhoeal discharge; therefore the maximum precautions should be taken, although many infections of babies' eyes are not of gonococcal origin.

In the event of occurrence of ophthalmia, there will be noticed a redness of the conjunctiva 3 days after the child is born. In a very short time the eyes are pouring out a thick creamy discharge. All may be well when the sockets are irrigated every 2 hours with a solution of boric acid, but in the event of neglect of

the condition a general necrosis of the eyeball occurs, with resultant blindness, or at the best, the cornea is left permanently opaque and vision is very poor. The nursing of such cases is therefore of supreme importance. The most modern method of treatment consists of removal of the pus by irrigation and then instilling penicillin (2,500 units per c.cm. in saline). The more frequent the instillations, the more rapid the cure and it is claimed that the disease can be controlled within a few hours or days when the treatment is given as often as at 5-minute intervals.

CHAPTER 15

TUBERCULOSIS

CAUSES. THE TUBERCULOUS PROCESS. VARIETIES. PREVENTIVE MEASURES. ACUTE MILIARY TUBERCULOSIS. PULMONARY TUBERCULOSIS. TREATMENT. FIBROID PHTHISIS.

Of all infectious diseases, tuberculosis is the most widespread. Owing to its ravages among all classes of the British people a special system of dealing with it has been evolved after years of research and it is satisfactory to note that there are evidences that in many of its forms tuberculosis is becoming much less prevalent than it was 40 years ago. During the years of World War II there was what it is to be hoped was only a temporary increase in the incidence of pulmonary tuberculosis. This was no doubt due to overcrowding in air-raid shelters, lack of housing accommodation and the difficulties associated with understaffing in sanatoria. In most countries the State has made special provision for the treatment and prevention of the disease and undoubtedly these great National efforts have proved that tuberculosis may be controlled if not stamped out altogether.

Causes.—First of all we must recognize that tuberculosis is a general disease affecting everybody. The organism responsible, the bacillus of tuberculosis—popularly known as "T.B."—is probably ubiquitous (see Vol. II, Section IV). At any rate it has been discovered in the air, in dust and in our food, and it can be transferred from the skin of one person to that of another. Furthermore the bacillus affects animals, especially cattle, and although the microbe of the cow is not quite the same as the human variety, in certain cases it can be the cause of serious tuberculosis in the human being. We must therefore be quite clear that tuberculosis is almost everywhere. On the other hand, while we must grant that the tuberculosis bacillus is a very powerful organism, with marked resistance, there is no doubt that certain people are born to fight and conquer it early and thus remain immune for the rest of their lives. In contradistinction to this others find that they are hereditarily disposed to the disease owing to a certain weakness of the protoplasmic cells, and while they are not necessarily born with tuberculosis active in their tissues, they find that when they first meet with the

bacillus in the outside world they are plunged into a long battle which may ultimately terminate in their death. Young children who suffer from tuberculosis are usually infected with the bovine type, but the human type may also be encountered and the reaction depends upon the resistance of the individual affected. If the latter is good there may be a short but sharp battle for a few days, coinciding perhaps with a localized inflammation of an abdominal gland. From that time onwards, the individual is probably immune, provided there are no extraordinary conditions during his life to reduce his vitality to a very low level. It is feasible to imagine that this incident happens to most of us at some time in our early childhood. There are many mild little feverish attacks and odd pains in the abdomen which seem to be part and parcel of the early years of our life and they amount to so many trivial occurrences which may be forgotten, but since so many people are found after death to have old T.B. gland lesions in the abdomen, it may be assumed that these are the remnants of the early battle ground where the T.B. was fought once and for all. Otherwise tuberculosis may attack us more virulently if we as children are not blessed with the maximum resistance, and thus variable processes of bone and gland inflammation are possible, the recovery from which may take some time, but usually ends in the establishment of immunity. Finally there is the class of people of both sexes who are susceptible to the human T.B., and who, either because they allow their protective powers to flag, or because they are exposed to some mass attack of T.B., become afflicted with pulmonary tuberculosis (phthisis) chiefly during the early years of adult life. This form of tuberculosis, popularly known as consumption, has been investigated by thousands of experts all over the world.

Granting, however, that the T.B. is very powerful, very toxic, lying in wait for us round every corner and very difficult to dislodge once it is " dug in," there are still many other reasons to account for the occurrence of tuberculosis in the human being. Long periods of debility following other infectious diseases—measles, whooping cough, influenza—may reduce the fighting power of the individual and make a breach in his defences through which the triumphant T.B. march like an army of occupation, using the main routes of the tonsils, intestines and pulmonary passages, to the glands, lungs and other organs. In the main, however, we find that tuberculosis is encouraged by neglect of the great fundamental laws of hygiene. Hundreds of thousands of cases have been traced to poor feeding, to inefficient ventilation, to dust and dirt, to irregular habits, to overcrowding and indeed to any of the factors which at present hygienists are striving to eliminate. We have said that the T.B. is universal,

but the microbe population of the modern city is stimulated to increase by carelessness of those who suffer from tuberculosis and who wantonly allow the organisms to pour into their environment. For instance the sputum of a phthisical subject is teeming with T.B., which can easily be demonstrated on a microscopical slide. If that person should spit on the pavement, the sputum as it dries will give rise to a column of bacilli which, rising to the level of other people's mouths, will claim not one but many victims who are unfortunate enough to inhale a microbe-laden volume of air at that particular spot. Coughing, sneezing and even breathing of a phthisical subject may send many bacilli into the air; it is a tough organism, and it can survive in dust and dirt until it finds a more delectable dwelling place. Again the spread may be brought about by the urine of a person suffering from T.B. of the kidney, from the faeces or from matter discharged from ulcers, abscesses or purulent glands. The transfer of T.B. from the cow seems to be inevitable in some cases. At least 10 per cent of all the milk sold contains T.B. Milk is a food which we all require in increasing quantity; children are encouraged to drink it and although to a certain extent precautions are taken to eliminate T.B. from the herds, the disease is still widely prevalent. For this reason no child should be allowed to drink raw milk. Efficient pasteurization of all milk would do much to eradicate the tuberculosis of bone and joint and gland. In summing up, we see that the town dweller runs far more risk than his country cousin. Insanitary occupations, congested houses and all the drawbacks of so-called "civilization" are ideal for the T.B.

The Tuberculous Process.—The name, tuberculosis, is used because the organism, as soon as it settles in a suitable spot—lung alveolus, lymphatic gland, lining of intestine or periosteal covering of bone—forms round it a small pearly-like tubercle, which can just be seen with the naked eye. Ultimately as these tubercles increase in number, they coalesce and form large areas of degenerated matter of the consistence of cheese. The poisons they exude not only destroy the surrounding tissues, but they also cause a constitutional toxaemia, resulting in great debility and so a vicious cycle is set up. In the course of time these cheesy masses break down and are discharged as sputum or pus. If, however, the patient has good resistance, his protoplasm may react so vigorously that calcification occurs and gives rise to a hard, solid mass which puts an end to the disease. The best reaction of all, however, is that of fibrosis; in this, the tubercles are surrounded by a network of dense fibrous tissue which shuts them off completely and thus "starves" the germs out. Many people show evidences of arrested tuberculosis, and it is a sign that while they may not be completely immunized they have at

least developed the power of dealing with an attack of normal virulence.

Varieties.—1. Acute Miliary Tuberculosis, a rapid disease often ending fatally; 2. Non-pulmonary Tuberculosis, including that of lymphatic glands, bones, joints, abdominal glands and membranes, including the mesenteric glands and the peritoneum, skin (lupus), urinary system and meninges; 3. Pulmonary Tuberculosis, or phthisis. The second group comes under discussion at various parts of this work; the first and third are briefly outlined below, but their full study belongs to the province of the fever nurse and not to that of the general nurse. Before going on, however, to the description of these forms we must discuss how tuberculosis may be prevented.

Preventive Measures.—These vary according to districts, but the National scheme stipulates certain main rules which should be strictly observed. The value of fresh air has been stressed in all quarters and the whole nation has been educated to the need for abundant ventilation and the open-air life. Since tuberculosis in all its forms is a notifiable disease, the public health authorities are aware of its incidence and special arrangements are made to educate the patient and his relatives by calling at the house and suggesting how best a spread of the disease may be prevented. The municipal clinics have done a great work in investigating early cases, in testing the sputa of contacts, in following the history of the cases and in keeping a watch over the afflicted person for many years. Every possible precaution is taken to ensure that the organism is counteracted by treatment of the patient, disinfection of the house, institution of a vigorous hygienic *régime* and regular supervision of the occupants. If the case should progress to a stage which demands hospital treatment, there are special hospitals, sanatoria and homes which deal with tuberculosis alone, and so have every modern method of investigation and treatment available. The danger of spread of infection by the dying is not lost sight of; in many cases the moribund patients are treated in a special ward of an infectious diseases hospital. Public education goes on apace. The average citizen is now fully aware of the dangers of T.B., and has benefited by the great campaign of publicity which by booklets, lectures, pamphlets, societies, exhibitions, posters and the like, has taught the man in the street to stop spitting, to sleep with his windows open, to seek fresh air by going to the country or seaside when possible and to preserve his food and drink from T.B.

Lastly the production and distribution of milk are controlled and supervised from the time the milk leaves the cow until it is put into the consumers' hands as already described (Section III).

Acute Miliary Tuberculosis.—This is the most acute form of tuberculosis. Spreading by the blood, the organisms become established in every part of the body and thus overcome the patient not so much by the local damage as by the great general toxaemia, which produces symptoms not unlike those of typhoid fever—irregular fever, rapid pulse, dry skin and all the evidences of a raging pyrexia leading to delirium and coma, followed almost inevitably by a fatal termination.

Pulmonary Tuberculosis.—Pulmonary tuberculosis can be classified as follows:

1. Acute pneumonic tuberculosis.
2. Acute bronchopneumonic tuberculosis.
3. Acute miliary tuberculosis.
4. Chronic pulmonary tuberculosis.
5. Fibroid phthisis.

Acute Pneumonic Tuberculosis.—This is a rare form which is very like acute pneumonia. It is not cut short on the 7th day, however, but lingers on until the ever-growing mass of tubercles ultimately overcomes the patient, death taking place in about 3 months.

Acute Bronchopneumonic Tuberculosis.—When this follows measles or whooping cough in children, it may be very like ordinary bronchopneumonia. The general toxaemia is serious and the local conditions diffuse, so that chances of life are small. If death does not occur within a few months, the state of phthisis is produced. This type is popularly known as "galloping consumption."

Acute Miliary Tuberculosis of the Lung.—This is simply the manifestation of the general acute miliary tuberculosis mentioned above. The whole course is over in a few weeks and generally ends in death. The signs are those of very acute bronchitis with cyanosis, breathlessness and high fever.

Chronic Pulmonary Tuberculosis.—This is commonly called phthisis, and chronic ulcerative phthisis, and is the outstanding type of tuberculosis with which the human race is afflicted. The disease begins in the alveoli or the small terminal bronchioles, which are the seat of tubercles just visible to the naked eye. The process passes through various stages of invasion, consolidation and cavity formation, each having its characteristic symptoms and signs. To begin with there may be no evidence of anything wrong beyond general weakness and a feeling of being "off-colour." It may be noted that the face is slightly flushed and the temperature may rise at night. Loss of appetite and constipation may suggest in young women the possibility of chlorosis. There is a recurrent cough, betraying continual irritation of the fine tubes of the lungs. During the stage of

consolidation, the patient becomes obviously ill, the cough growing more troublesome and the general asthenia more marked. There is great lassitude and lack of interest in anything and the temperature is so constantly elevated in the evenings that the patient may have to go to bed. When the disease is fully developed, we have the typical picture of phthisis before us. The cough becomes hacking and sometimes painful, small quantities of blood-streaked, yellowish-white, knotted-looking sputum are coughed up, the temperature swings a good deal, sweating at night is marked and there may be diarrhoea. When large cavities form there may be serious haemorrhages from the lung. Coincident with these symptoms the signs are characteristic. The pulse is fast and small and the chest may actually show hollowings over the site of cavities or of collapsed lungs. The patient becomes extremely thin and wasted.

In less serious or successfully treated cases, the disease is arrested by the formation of calcified tubercules or fibrous capsules and the patient rapidly improves. In many instances, however, there may be complications such as pleurisy (which often is the first evidence of trouble), empyema, laryngitis, a spread to the meninges and intestines or a condition of air-pocket in a cavity due to communication with the external air through a bronchus, called pneumothorax. Haemoptysis may occur in various ways. It may amount to a few streaks of blood, as described above. It may be frothy and bright red and come up in mouthfuls. In fatal haemorrhages from vessels which burst because they are left without support the loss of blood is enormous, and the patient dies in a very short time. The cough is of hacking type and occurs in spasms; it may cause distress owing to pain and vomiting. The sputum increases with the spread of the disease and it is full of T.B. In the later stages there is a mixed infection. Ultimately the loss of flesh, the prominent scapulae, the protruding ribs, the pale face with hectic flush, the weary eyes, the clubbed fingers and the curved nails complete the picture of active phthisis. Many cases of fistula-in-ano, an abscess which gathers close to the anus, are due to spread of T.B. from lung to intestine by swallowing of the sputum.

X-rays are of great service in demonstrating consolidations and cavities. Nowadays it is customary to examine large groups by mass miniature radiography. About half a dozen tuberculin tests may be done in the eye, on the skin and on the blood but none are entirely satisfactory.

Treatment.—A mere outline of the treatment is possible in this work. The preventive measures have already been mentioned, and patients can be instructed to spit into old rags or paper which are immediately burned, or into a sputum mug with lid and containing a powerful disinfectant. Special blue glass,

screw-top pocket spittoons are provided for those who may require to spit when outside. Of the various inoculations and tuberculins, and the more recent experiments with gold-sodium compounds, little need be said. Each has its school of devotees, but none is infallible. Streptomycin is still in its experimental stage, but much is hoped from it and some cures have been reported (see. pp. 131–132). The great stand-by is still plenty of good fresh air, modified, for those who can afford it, by the snows of Switzerland or the breath of South Africa. The *régime* of sanatorium treatment involves a strict course of graduated work, exercise and treatment. Good food, including plenty of sound milk, is essential. Each symptom must have special treatment as it arises. By inducing artificial pneumothorax, in which air or nitrogen is gently supplied to the pleural cavity of one side, a pressure can be set up which helps to collapse the affected lung, and thus healing is induced. Refills are necessary from time to time. Considerable advances in surgery of the chest have made it possible also to perform operations such as phrenic avulsion, thoracoplasty and total pneumonectomy in selected cases. Haemoptysis must be dealt with promptly when it is severe. Complete rest, quiet, the application of a hot fomentation to the abdomen and the giving of ice to suck are helpful. Patients who have night sweats value the cold sponge and a change of clothing.

Sanatorium treatment may make the patient fit to resume his normal life with certain mild restrictions. The public health authorities will see that regular supervision is maintained; the various tuberculosis dispensaries are aware of the movements of all their charges. Treatment of phthisis is thus in a most efficient state and the consumptive can be assured of the most modern and most encouraging treatment from the earliest days of his disease.

Fibroid Phthisis.—When fibrosis occurs round a certain tuberculous area the disease is arrested, but in some cases the supporting or interstitial tissue of the lung is affected more than the cellular regions. The signs are those of interstitial pneumonia, but T.B. may be found in the sputum. A large caseated area or a cavity may become shrunken by subsequent fibroid changes.

CHAPTER 16

DISEASES OF THE SKIN

DEFINITIONS. ABNORMALITIES OF FUNCTION. SYMPTOMS. TREATMENT. ECZEMA. RINGWORM. ATHLETE'S FOOT. SCABIES. OTHER SKIN DISEASES. IMPETIGO CONTAGIOSA. PSORIASIS. URTICARIA. HERPES ZOSTER. SEBORRHOEA. ACNE. PRURITUS. LUPUS VULGARIS. ERYTHEMA NODOSUM. DRUG ERUPTIONS. DISEASES OF THE HAIR. DISEASES OF THE NAILS.

If we regard the skin as the outer defence works of the body, we can readily understand that it must be exposed to the rough and tumble of modern life and to the general wear and tear of the daily round. The skin normally has the power of protection and resistance, but it becomes injured frequently by cuts, lacerations, abrasions, burns, scalds and other damage which render it liable to microbe attack, since the continuity of the surface is broken and the great armour of the epidermis is faulty. Many of the skin diseases are due to microbes, some to parasites and others to causes which are to be found inside the body. Inflammation of the skin of a local or general nature, accompanied or not by sepsis, is the commonest form of disease, but there are many other interesting defects which give a clear and unmistakable picture and which include the various rashes, the papular and scaly eruptions and several other peculiar changes. Since skin disease is characterized by certain distinctive features, it has a terminology of its own and our first study must be that of the various definitions in common use.

Definitions.—Probably the simplest abnormality of the skin is the macule, a term which is used to describe a spot of sizes varying from that of a pin-point to that of a diameter of several inches. In this condition there is neither pitting of the skin surface nor elevation of the spot above the normal plane, Perhaps the best example of the macule is to be found in the rose-coloured spots of typhoid fever, but the colours may vary as well as the size, and there may be shades of yellow, brown, red and purple. When the spot is due to minute bleeding, we use the term, petechia; on a massive scale, bleeding under the skin (e.g. in the typical " black eye ") is called ecchymosis. The

latter may also appear after severe sprains or contusions. When pimples or small mound-like elevations appear on the surface of the skin they are referred to as papules or nodules, depending upon their size. Such types are found in many rashes of infectious fevers and they may pass through various stages of development, degeneration and healing. For instance in smallpox, as we have already seen, the initial papule becomes a vesicle, which is a circular or oblong bleb containing serum; this becomes a pustule containing septic fluid and finally a hard dry scab. In some cases the papule develops into a wart, which is a hard papule without fluid. Eczema is a disease which is characterized by papules which are bright red and inflamed and which may form small blisters that eventually burst. In syphilis the papule is typically copper-coloured. Sometimes the papule becomes completely degenerated and forms a small ulcer, but usually it ends in a scale, the latter being characteristic of eczema, psoriasis (in which the scales are silvery), and in seborrhoea (in which the scales are dry and brittle and are called collectively dandruff). The nodule is usually associated with a constitutional disease such as rheumatism. It occupies the whole thickness of the skin and has a wide base; on the other hand a skin tumour involves the skin and the underlying tissues as well. When there is an irregular elevated plateau of the skin, appearing suddenly (as in a person stung by a nettle or suffering from nettlerash) and containing serum, the condition is known as a wheal. These swellings disappear as quickly as they arise, and may be caused by the bites of fleas, gnats, horseflies and other insects. In certain states of the blood (e.g. pemphigus—referred to in the previous chapter) large blisters arise, some with bases as big as a penny. To these we give the special name of bullae; they are "outsize" vesicles. Boils, abscesses and carbuncles may form in the skin as the result of pyogenic germ activity; they pass through the stages which are described in Vol. IV, Section X. Despite all these natural occurrences, it must not be forgotten that artificial agencies may be at work. All kinds of excoriations may be found, generally the result of scratching; the skin may thus become torn, fissured, ulcerated or even gangrenous.

Abnormalities of Function.—The chief functions of the skin may be interrupted or perverted. Thus when the capillary circulation is increased over a wide area and a red blush produced which disappears on pressure, we call the condition erythema. Many rashes are of this type. Pain is not a very common complaint in skin troubles, itching, loss of sensation and acute discomfort being the main symptoms. Severe itching, generally affecting the folds of the skin and driving the patient almost to distraction, is called pruritus; the tunnelling of the

acarus or the bite of the louse may also lead to severe itch which causes the patient to scratch. The sweat glands may be excessively active (hyperidrosis) or completely dried up (anidrosis); the sebaceous glands, which normally supply the skin with its polish of sebum, may become over-active and inflamed, producing the well-known seborrhoea. A severe inflammation may be found, involving all the layers of the skin and known as true dermatitis, but apart from that there is a mild superficial inflammation in all skin diseases which run an active course. Very often the pigment cells of the lower epidermal layers become excessively active and the skin becomes bronzed or brown; this is most commonly seen after exposure to the sun but it is also a sequel to certain long-standing skin diseases.

Symptoms.—The general symptoms of skin diseases must be taken with a review of the history of the case. After finding from the patient how the disease began, how it developed and its main characteristics, the questions regarding itch, discharge, discomfort or disability must be put. Many skin diseases are part of a general ailment, and work, habits, diet and domestic circumstances must be taken into consideration. It is often advisable to use a magnifying glass, especially in suspected scabies and similar diseases. Most skin diseases have their regular " haunts " on the surface of the body; some prefer the folds of the skin, some the joints, some the hands and some are widespread; the diagnosis is therefore made easier if we carefully map out the distribution. Using the definitions enumerated above, the nurse should describe the local condition, taking a small " sample " area and making up her mind whether there are macules, papules or pustules, coming to some decision as to the size of each eruptive unit and noting the colour. She should be able to say whether the vesicles or pimples occur in groups or whether they are scattered singly over the skin; a map of the affected surface should be made in order to find out whether or not the disease is symmetrical. She should make sure that she knows whether there is an infectious fever in active process as this simplifies matters considerably and often clears up mysteries about unusual skin manifestations. Finally she should remember that syphilis is the great mimic of skin diseases as already emphasized (Chapter 14); many eruptions which have puzzled even the experts at the beginning have turned out to be of a syphilitic nature.

Treatment.—The general treatment of skin diseases consists of local and of constitutional treatment, and the nurse must realize that the latter is as important as the former; indeed many eruptions quickly heal up when the primary disease is dealt with by medicines taken by the mouth. Well-known skin tonics

are arsenic, iron and cod-liver oil and malt. These act by improving the quality of the blood and therefore of the cells of the skin.

The local treatment may be carried out in various ways. As a rule, ointments are favoured, partly because of custom and partly because the greasy basis is soothing and protective. Whenever the skin becomes abraded, many very sensitive nerve organs are exposed to the air and the pain is severe until the area is covered up. But powders or lotions may be equally efficient in particular cases.

In general the approach to a long-standing or well-established skin disease is by making a thorough clearance of the area. If a skin lesion is left to itself even for a day, the exudation, the scales, the grease and the dirt combined—probably with a small amount of dried blood resulting from scratching—are matted together into yellowish-brown crusts, which may be strongly adherent, and it is futile to begin the curative treatment until these have been removed and the diseased surface exposed. The methods of dealing with parasites of the head and body have already been discussed (see Vol. II, Section III, Chapter 8). In many common skin diseases e.g. impetigo, which forms golden-brown scabs on the face and affects school-children in large numbers, great patience is required to remove these hard crusts, but by a plentiful supply of warm boric acid solution and gradual softening with small pledgets of cotton wool, they are thoroughly dissolved or broken up and the real site of the disease is exposed. In very bad cases it may be necessary to apply a dressing consisting of olive oil on lint, the application being left on all night. Eczema may demand the application of starch poultices for 24 hours, so that the crusts may be removed. There are various ways of making the paste for this poultice, but as a general rule to 2 oz. of cold water starch should be gradually added small quantities of warm water until a fairly thick cream is produced. Into this may be put a teaspoonful of finely powdered boric acid if necessary, and then 1 pint of boiling water is quickly stirred in, the mixture being kept in motion until the clear jelly is obtained. After cooling, the starch may be applied in exactly the same way as the linseed poultice and can be left on for a night. In severe cases fresh poultices may be put on every 4 hours.

Eczema

Eczema has well been called the "refuse heap" of skin diseases. When there is any unusual condition bearing some resemblance to this disease it is generally put down as eczema, and thus it is very difficult to describe the true variety. Indeed, the nurse may find that often she is face to face with some

imitation, but since the treatment is in many cases similar to that of eczema proper, she may be assured of succeeding in doing her work of relieving the condition, whatever it may be. The best examples of true eczema are seen in babies, and in those who are probably of asthmatic tendency and thus subject to eczema. Here we realize the vagaries of the disease—its sudden appearance, its widespread distribution, its irregular course and its tenacity. The cases of inflammation which appear as the result of external irritation by chemicals, drugs, soaps, face creams, dye in feathers, fur or wool or the powerful rays of the sun, should be classified as dermatitis, eczema being regarded as an inflammation of the skin proceeding from a central cause.

Symptoms and Signs.—There is usually a preliminary itch, and then local erythema is evident; the patient cannot restrain his nails and soon there are excoriations, generally forming a " weeping " surface due to exudation of serum. In a very short time collections of papules, vesicles, crusts, scales and sometimes pustules may be seen. The disease may run an acute or chronic course—usually the latter—and there is no mistake about the long drawn out nature of the complaint. While the acute cases quickly pass through the various stages to a healing stage, the chronic types may cover the body for long periods with moist uncomfortable patches which seem to linger longest in the folds of the skin or where the surface is delicate. Thus apart from the head and face, which in infants may be covered with the disease, the common sites of eczema are the webs of the fingers and toes, the bend of the elbow, the region behind the knee and the fold of skin behind the ear. Women with large pendulous breasts often become affected with eczema on the approximated areas of the skin. " Sensitive " children may show eczema on the area covered by the napkin. The special name of intertrigo is given to the condition found in the last two instances.

Treatment.—Dry eczema may be relieved by the use of fine protective powder made of talcum and boric acid. But it must be remembered that all kinds of eczema must be handled in a very delicate fashion, having regard to the sensitivity of the patient's mind as well as his skin; eczema is a trying disease and causes great mental irritability so that the cure must not be worse than the disease. In the moist cases, assuming that the preliminary cleansing has been done by starch, we may use ointments as protectives and curatives, but the fat may become irritant and the dressing should be changed at 6-hourly intervals. All ointments should be lightly applied—not rubbed in—and should be covered with a layer of plain gauze and of lint. The old ointment must be carefully removed before the new is applied. Unless the weeping is marked, however, a very

efficient application is powdered boracic acid and prepared calamine made up into a lotion with glycerine and lime water. In cases of marked pain more soothing lotions are indicated. One of the essentials is the exclusion of air, therefore the protective dressings should be substantial. If there is any danger of the dressings becoming too dry, gutta percha tissue may be placed over the lint. Sulphonamide cream is sometimes used when there is a secondary infection of the eczema. There is, however, a risk of this causing persistent dermatitis and for this reason, it should not be applied for more than 4 or 5 days. Penicillin is sometimes also applied, either in conjunction with sulphonamide cream or as a penicillin ointment.

It should never be forgotten that gout, asthma and similar diseases may be the fundamental cause of eczema, and it is necessary to diet the patient for these conditions according to the routine described on p. 189.

Ringworm

A certain fungus called the tinea, of the vegetable order of parasites, is responsible for disease which attacks the hair, skin or nails. When examined by the microscope, this mould is seen to be made up of small threads called mycelia and round egg-like bodies known as spores. Ringworm of the hair (*tinea tonsurans*) must have special investigation as it is by far the commonest form of ringworm in children and usually disappears spontaneously at puberty. Ringworm of the beard (*tinea barbae*) is caused by the *Trichophyton*, a large-spored ringworm which also affects the skin, in contradistinction to the small-spored ringworm (*Microsporon audouini*) which is the cause of ringworm of the scalp. We have already mentioned that the diagnosis can be established by Wood's glass (see Vol. II, p. 177). Generally the disease becomes evident about a fortnight after infection, beginning as a single papule which spreads outwards and becomes scaly, thus forming an irregularly circular patch of dry scurf on the scalp. These patches may vary in diameter from ½ inch to 2 inches. The recognition of ringworm, apart from Wood's glass method, is not very difficult. The hair on the patch is thin, but what is left of it is dry and withered in appearance, having lost its gloss and its " life "; certain hairs are short and broken off while others look as if they had been trampled upon like a field of corn into which a herd of wild cattle had careered. The hairs can be pulled out easily, and they show a degeneration at their roots, this being due to the fungus which has worked its way down the hair follicles. The parasite also clings to the hair itself. Occasionally a form of ringworm of the skin is found on the forearm especially, and

known as *tinea circinata*, on account of the fact that its patches are encircled by a ring of small papules.

Treatment.—There is no treatment worth considering nowadays other than the use of x-rays. Prior to the treatment, the child should be isolated, the hair of the area round the patch being cut short and iodine applied; a close-fitting linen bonnet should be provided. It is often advisable to destroy the communal brushes and combs of the household and also to burn the hat which the child has been wearing. Most schools now form with others a central ringworm clinic at which experts give the treatment; the general principles are to remove the hair and the ringworm with it; the scalp is stimulated to produce a fresh crop of luxuriant hair in a very short time. All the time the child is under observation he can be segregated, but his education can continue. Otherwise ringworm of the skin, as opposed to ringworm of the scalp, may be regularly treated by daily applications of liquor iodi mitis, the area being covered up during the process. The cure is usually rapid. The use of thallium acetate, a drug given internally to cause epilation of the scalp, is satisfactory but accidents may occur if the amount of drug, calculated according to body weight, should be exceeded.

Athlete's Foot.—Ringworm of the toes (athlete's foot) is a common condition. It is often contracted from swimming pools, gymnasia and similar public places in which people go about with bare feet. It usually commences as a sodden crack between the 4th and 5th toes. It spreads and may involve all the toes and the sole of the foot. The nail beds may be infected. Sometimes the disease is transmitted to the hands as it is very infectious.

Treatment.—Meticulous attention to personal hygiene is essential. Socks and stockings must be changed daily and washed (or boiled when they are cotton) in a solution of "Dettol" or similar disinfectant. Feet should also be washed at least once a day, dried thoroughly and all dead skin cut away. Salicylate ointment, benzoin ointment or paints containing perchloride of mercury, salicylic acid and industrial spirit are sometimes effective. It is important that excessive perspiration should be checked; and boric acid powder applied to the stockings or used for "dusting" the feet after washing is helpful. If the nail beds become affected it is often necessary to remove the nails to ensure efficient treatment. Care must be taken to prevent infection of other people. The use of communal bath mats should be avoided. After the bath has been in use it should be cleaned out with strong "Lysol" solution.

Scabies

Scabies—or the common itch—has already been referred to (Vol. II, pp. 109–110). In all extensive warfare, the armed forces have intimate acquaintanceship with this disease. The symptoms are divisible into 2 groups: 1. those which are the result of the burrowing of the female acarus in the trenches she makes under the skin, and 2. the subsequent sepsis. Properly, therefore, scabies is a dermatitis.

Symptoms.—A maddening itch, which grows more unbearable towards evening when the patient sits too near a source of heat or when he becomes warm in bed, is the outstanding sign of scabies. As the patient makes a more or less vain attempt to dislodge the acarus or her offspring from the skin, excoriations are formed and often septic spots are produced. The favourite hunting grounds of the acarus are the webs of the fingers, the bends of the wrists and elbows, the hips, the genital organs, the ankles, the skin under the breasts in females and inside the umbilicus. The burrows may be seen by the naked eye, but better with a magnifying glass; they are shafts about ¼ inch long leading under the horny layer of the skin and appear as little irregular black lines. The burrow may be capped by a pustule.

Treatment.—The one thing to avoid in scabies is over-treatment. Many cases of severe sulphur dermatitis have proved that the cure may be worse than the disease. However, if thoroughly treated, scabies can be banished very speedily. The old form of treatment used for many years was one in which the patient was put into a hot bath, sometimes containing a little liver of sulphur, and provided with plenty of soft soap and a scrubbing brush; he was made to scrub his skin vigorously all over, not a single inch being left untreated. The skin was dried and sulphur ointment was then well rubbed in; this treatment went on twice daily for several days. However successful the results may have been, the whole process was messy, exacting and unpopular.

The more modern method of treatment is to apply an emulsion of benzyl benzoate to the whole body. A warm bath should be taken beforehand and the emulsion allowed to dry into the skin and remain for 48 hours by which time the cure should be complete. There is no risk of dermatitis.

Other Skin Diseases

Impetigo Contagiosa.—As mentioned above, impetigo, very common in school-children, forms unsightly scabs on the skin of the face and may spread to the fingers, especially in young children. The organism responsible is thought to be a staphylo-

coccus and the infection is conveyed by the fingers. The first sign is usually a small red pimple on the face, generally near the mouth. This becomes vesicular and exudes a clear yellow serum which hardens quickly and forms an irregularly circular patch about ½ inch in diameter. As the scab hardens it collects much of the dirt from the atmosphere and becomes yellowish-brown. Generally speaking the neighbouring glands are enlarged and the child is pale and in a poor state of health.

Treatment.—Impetigo is very infectious and spreads quickly through schools and institutions, therefore great care must be taken to ensure that infection is not carried by towels and other fabrics. The finger nails should be cut short and the toilet of the lesions carried out with great care. Isolation of the infected person should be the rule. Ordinary disinfectant methods should be adopted to deal with the clothing. Gloves should be worn during the night to avoid scratching during sleep.

Penicillin sprays, lotions or creams are the most modern remedies in the treatment of this disease. Sulphonamides have been used but there is a risk of sensitivity to their local application. Ammoniated mercury ointments (5 grains to the ounce) are effective, but the scabs must first be removed with starch poultices, so that the shallow ulcer beneath, which is the active site of the disease, is exposed. A paste consisting of ammoniated mercury, sodium salicylate, zinc oxide and starch is simpler in its application than is the above ointment, since it obviates the necessity for the starch poultice. When there is only one patch of impetigo it will heal if covered securely with a piece of "Elastoplast" for a few days.

Fresh air, cod-liver oil and malt and attention to the general quality of the diet are indicated when the physical condition is poor.

Pemphigus neonatorum is a skin disease of the newly born. It can be contracted from older children and adults who are suffering from impetigo and other staphylococcal infections. If the umbilicus should become involved the disease may be rapidly fatal. As already mentioned (p. 414) another type of pemphigus in infants has its origin in congenital syphilis.

Psoriasis.—This disease is familiar on account of the glistening, silvery scales which form in patches over the site of the lesions. Of all skin diseases psoriasis is most baffling; the patient is very concerned about the unsightly patches, which congregate especially on the back of the elbow, on the front of the knee and on the scalp. Psoriasis may also affect the nails. There is no exudate and therefore the scales are dry and usually fall off like withered leaves from a tree, but when we try to dislodge the more recent ones we find that a red, often raw area exists below, the papillae showing red, angry-looking points. Often psoriasis

may be left for such a long time that it forms quite an accumulation of scales which are like hard horny plates. The disease runs in families and there is no connexion with tainted blood or serious constitutional defect. It may show itself first when the patient is at school and may persist throughout life. Treatment may bring temporary relief, but owing to the fact that messy and unsightly ointments may be required, the course is often considered not to be worth all the trouble and discomfort. The most successful form of treatment consists of applying—at the affected sites only—an ointment containing either chrysophanic acid or chrysarobin. It is essential that the patient should go to bed, and the personal clothing and bed-clothes should be of the oldest material, since they are ruined by the drugs and are usually destroyed afterwards. Internally arsenic and iron tonics may be given, and thyroid extract is also useful.

Urticaria.—This is also known as nettlerash. It has a strong relationship to acute eczema, as it occurs suddenly and generally after the patient has eaten some food which does not agree with his constitution. But urticaria may also be due to certain external irritants. It is therefore to be regarded as a kind of pain barometer which indicates the individual peculiarity towards certain influences. Common causes of urticaria are shellfish, strawberries, oatmeal, mushrooms, wool, fur, stings and bites of insects, dandruff from a horse or cat, threadworms, gout and the touching of certain plants, particularly the stinging nettle, which gives its name to the disease. Sensitivity to certain drugs, e.g. the barbiturates and sulphonamides, may produce urticaria. Serum sickness is also a similar manifestation of sensitivity, as already stated (see p. 363). As a general rule, the itching starts as a small wheal, which is intensely itchy, and very soon the whole skin is covered with red patches, some merely examples of marked erythema, others raised into the typical wheal. Urticaria may disappear as quickly as it comes, the treatment usually consisting of the giving of a mercurial purge followed by a saline next morning, together with the adoption of a day of semi-starvation, during which abundant fluids are drunk. A warm bath containing a quantity of sodium bicarbonate is soothing to the skin. The local patches may be treated with healing lotions, or with gauze saturated with sodium bicarbonate solution. Urticaria may also attack the mucous membranes.

In angioneurotic oedema (giant urticaria) localized swellings of the face, eyelids or lips may occur. This may give rise to serious oedema of the larynx with subsequent suppuration if the condition is not treated efficiently. Occasionally oedema of the brain causes collapse, unconsciousness or epileptiform fits. The administration of adrenalin (1–1,000) 5 minims, relieves

the immediate situation, but the cause of the attacks must be sought and dealt with.

Herpes Zoster.—Commonly associated with neuritis, herpes zoster (shingles) occurs as crops of small vesicles grouped round the distribution of certain nerves, particularly those of the chest. This type of skin disease must not be confused with the small groups of blisters commonly found in colds and in pneumonia around the mouth of the patient, and then known as catarrhal herpes. Herpes zoster has now been proved to be caused by the same virus as that of chickenpox. It runs a definite course, and ultimately disappears when the vesicular scabs dry and drop off. There is pain both in the nerve and at the site of the vesicles. The scabs should be kept well dusted with talcum and boric acid powder.

Seborrhoea.—When the sebaceous or sweat glands become choked with excessive secretion which has dried, or when their usual function is greatly diminished, groups of microbes become active. In seborrhoea, the flow is excessive, and as a result of this the dried greasy scales of the skin are increased. They are shed as the well-known dandruff from the scalp. An occasional shampoo with spirit, ammonia and sodium carbonate scalp lotion will remove all the extraneous scurf and leave the pores and other orifices clear. A tar lotion acts as an antiseptic.

Seborrhoea may spread to the face and look very like eczema, and sometimes it appears on the shoulders and the front of the chest and forms light yellow or brown patches which are very itchy.

Acne.—Many young people, especially males, suffer from acne or blackheads. The condition is often associated with seborrhoea. It usually disappears at the age of 25, but it may become so infected with mixed germs that pustules and pitted scars are left which are landmarks for the rest of the patient's life. The cause is a hard plug (comedo) which obstructs the outlet of a sebaceous gland and the secretion, accumulating behind the plug, causes a small swelling which may become a

FIG. 69.—BEDDOE'S COMEDO EXTRACTOR.
(By courtesy of the Surgical Manufacturing Co., Ltd., London.)

pustule. The chronic disease may go on for years. The common sites are the face, the back of the neck and the shoulders. If plenty of sweating is encouraged, acne may be kept in check. Vigorous toilet of the face with pumice-stone soap and other

similar applications removes the hard caps and allows the emptying of the pimples; this can also be done by the comedo extractor (see Fig. 69). Various dietetic measures have been adopted, and the food should contain plenty of green vegetables and fresh fruit. Yeast or some form of vitamin-B preparation is sometimes helpful. Vaccine treatment may have success if it is persevered with. Ointments are not to be recommended, as they tend to block up the pores still further, but various lotions of an antiseptic type are of use. The bowels should be kept loose.

Pruritus.—A condition of itch of almost unbearable type, as already described, may be associated with diabetes, over-excited conditions, hysteria, jaundice and dyspepsia. Local sedatives may be required. In many cases the perianal region is the most seriously affected and homely relief is obtained by lathering well with a good soap and allowing the lather to dry as a powder. Hot alkaline baths are also efficacious. The general condition must be dealt with.

Lupus Vulgaris.—This is the name given to tuberculous disease of the skin. It must not be confused with lupus erythematosus, which forms a peculiar bat-like or butterfly-like patch of erosion centred on the bridge of the nose and spreads out on either side over the cheeks. Lupus vulgaris appears primarily as soft nodules of clear matter and of jelly-like consistence, very like apple jelly in colour and quality. The process is one of slow destruction, like tuberculosis elsewhere. The whole thickness of the skin may be involved and the tissues below (e.g. the cartilages of the nose) may be slowly eaten away, leaving very unsightly areas. Cases have been known to go on slowly progressing for 25 years. Recently successes have been reported as a result of the administration of calciferol (vitamin D_2). In addition general ultra-violet light irradiation or local irradiation by means of the Finsen lamp is advocated. The general health should be promoted by an ample diet, fresh air and iron tonics as in other tuberculous infections. The use of x-rays is not now to be recommended as they tend to produce a persistent dermatitis which may become malignant. The use of carbon-dioxide snow is sometimes efficacious; the action is one of intense local frostbite and the treated area later sloughs off.

Erythema Nodosum—This is a fairly common skin condition which is associated with infections, especially those of rheumatic fever and tuberculosis. The lesions appear on the front of the shins and more rarely below the elbow along the line of the ulna. They are round or oval, deep pink and oedematous. They appear suddenly and fade gradually in a few days, like bruises. There is local tenderness and general malaise

with a rise of temperature. The treatment consists of rest in bed, with local applications of lead lotion. The cause should be investigated in each case, since early pulmonary tuberculosis is commonly discovered.

Drug Eruptions.—Nearly all drugs produce abnormal reactions in certain persons. This may be due to idiosyncrasy (abnormal reaction to normal dosage) or to allergy which occurs in persons who have acquired sensitivity by previous medication with that particular drug. Certain skin eruptions which have healed predispose to other types of eruption. Overexposure to the sun may precipitate a drug dermatitis. The most common drug rashes are outlined, as it is obviously impossible to give a detailed list.

Bromides.—These frequently cause a condition resembling acne, more rarely lesions like those of smallpox, warts, boils and carbuncles. Unborn babies may be affected by bromides given to the mother, and after birth from her milk.

Iodides.—Iodides may produce a variety of lesions—from a simple erythema to large eruptions like new growths. Iodism may be most serious and even fatal.

Barbiturates.—Luminal (phenobarbitone) often produces a rash like that of scarlet fever. Occasionally a more serious form of dermatitis may occur when the drug is not discontinued.

Santonin.—Santonin may give rise to an urticarial eruption.

Sulphonamides.—The skin lesions produced are various. There may be high temperatures (drug fever) and other symptoms of toxaemia. The rashes may resemble any one of those associated with the specific fevers. They may be localized or generalized; sulphathiazole sometimes causes a rash like erythema nodosum. Occasional fatal dermatitis has been reported from sulphonamide administration. Rashes occur most commonly in persons who have had previous medication. Ointments and other local applications are particularly likely to produce sensitivity. The rash usually clears when the drug is discontinued. Copious fluids and mild purgatives should be given to assist elimination. Exposure to the sun or to x-rays should be avoided. The blood is usually examined in view of the danger of agranulocytosis.

Sera and Vaccines.—These may give rise to urticaria, vomiting and fever, and effusions into the joints, especially in persons who have had previous injections.

Gold Eruptions.—Eruptions caused by gold therapy are red and scaly. They produce sensitivity to light and occasional permanent pigmentation.

Industrial Dermatitis.—Industrial (occupational) dermatitis may be caused by an almost endless variety of agents. Thus ulcerative or cancerous conditions are sometimes set up in workers who come into contact with tar and soot e.g. " chimney

sweep's cancer," involving the thighs and scrotum. Doctors and nurses have suffered as a result of work involving the use of x-rays and radium, although this is now rare owing to greater protection. Dermatitis may occur from friction due to dust or sand. Strong acids and alkalis produce skin lesions. The domestic worker may develop dermatitis from the too liberal use of strong soaps and soda. Handling of dyes and paints may give rise to dermatitis in susceptible persons. The above are merely examples, and by no means exhaust the list of affections of the skin due to occupation.

Other agents.—The other factors in the causation of dermatitis include hair dyes, face powders (particularly those containing orris root which is very prone to produce allergic conditions), lipsticks, depilatories and deodorants, dyes in clothes, stockings and boots.

Diseases of the Hair.—The hair follicles may be invaded by bacteria or fungi. Most of these conditions have been already described and include impetigo, eczema, ringworm, favus (crested ringworm) and sycosis (barber's itch).

Greyness.—Greyness of the hair is a normal acquisition of advancing years, but in albinism pigment of the hair is congenitally absent. This is associated with a general lack of pigment in the skin and eyes. Greyness or whiteness of the hair due to prolonged mental or physical illness is a common condition and the association of worry with grey hair has become a *cliché* of our everyday speech. Severe headache and neuralgia may promote greyness over the affected area. In the condition known as vitiligo, in which the skin has a piebald appearance due to patches of decreased pigmentation on a background of increased pigmentation, the hair is often quite white in patches, the remainder being comparatively free from greyness. This is probably a functional nervous disorder and usually occurs in persons of an excitable or worrying nature. No treatment is successful in curing grey hair, except dyeing it, which as a rule is not recommended. Dermatitis and alopecia (baldness) are occasionally produced in susceptible persons by the use of hair dyes.

Alopecia.—Alopecia is occasionally a congenital condition, but this is rare. Baldness occurring in men between the ages of 30 and 40 years is common enough to be considered a normal condition. It sometimes occurs in women during or after the menopause. Diffuse and sometimes complete alopecia may result from the acute fevers, especially influenza and pneumonia. Too intensive x-ray treatment for ringworm may cause complete and permanent baldness. A patchy type of baldness known as alopecia areata is usually the result of overwork, worry or mental trauma. Syphilitic alopecia is a streaky baldness, which manifests itself about a year after infection. General debility

and thyroid insufficiency also cause thinning of the hair. Burning and other accidents to the scalp cause scarring on which it is impossible for the hair to grow. Treatment of alopecia depends entirely on the initial cause and may be either physical or psychological. Baldness due to advancing years is usually incurable, but patchy types of alopecia improve with general and local treatment, which consists of friction and stimulating ointments and lotions. The hair when it grows is often grey or white and this may be permanent. Syphilitic alopecia responds as a rule to antisyphilitic measures.

Hirsuties.—Hirsuties (excessive hairiness) often occurs in men, and is usually an exaggeration of normal hair growth. In women abnormal hairiness frequently has a male distribution, and in some instances a complete beard and moustache have been known to develop. Hirsuties is due to endocrine imbalance particularly excessive secretion of the cortex of the adrenal glands. In the condition of spina bifida tufts of hair are sometimes found in the lumbar region. Treatment of hirsuties is usually unsatisfactory unless the underlying endocrine conditions can be remedied, which is difficult. Electrolysis is sometimes employed, but its application is painful, and scarring results from its use. X-ray treatment sufficient to destroy hair growth may produce a serious skin condition. Depilatories, shaving and bleaching are probably the safest methods.

Diseases affecting the Nails.—Any of the common skin diseases may produce changes in the nail e.g. psoriasis causes a peculiar pitting of the nail. Sepsis of the nail bed or surrounding tissues causes whitlows (paronychia) and is a common condition in persons whose hands are subject to trauma. The " hang-nail " is probably responsible for a great deal of sepsis, providing a portal of entry for many kinds of pyogenic bacteria. Painless whitlow is associated with a disease of the nervous system known as syringomyelia. Syphilis also gives rise to painless sepsis of the nail bed.

Ringworm of the nails of hands and feet has already been described. Warts surrounding the nail are fairly common. Excessive growth and hypertrophy of the nail is known as onychogryphosis and may resemble a parrot's beak. Longitudinal lines on the nails causing splitting are common in diseases of the skin. Transverse lines appear as the result of illnesses, especially those associated with high fever during which the nutrition of the nail is impaired. White spots on the nail have no special significance; they are due to minute bubbles of air.

Spoon-shaped nails may be a congenital defect, but they also occur in chronic microcytic anaemia. Enlarged shiny nails, the convexity of which is exaggerated, and club-shaped finger ends, are typical features of chronic heart and lung disease.